

Overview

Overview of iMac Pro (2017)



Features:

- Display: 27-inch 5K Retina Display
- Processor: 8-Core, 10-Core, 14-Core, 18-Core
- Graphics: Radeon Pro Vega 56 graphics processor with 8GB of HBM2 memory
- Configurable to Radeon Pro Vega 64 graphics processor with 16GB of HBM2 memory
- Ports:
 - Nbase-T Ethernet
 - Four Thunderbolt 3 (USB-C) ports
 - Four USB 3 ports
 - SDXC card slot
- T2 chip with new security features including:
 - Secure Enclave
 - Encrypted storage
 - Secure boot

For full technical specifications, refer to Apple Support Tech Specs: www.apple.com/imac-pro/specs.

Important Service Considerations:

- The iMac Pro (2017) will not start up after a logic board and/or flash storage replacement until the **Mac Configuration Utility (MCU)** is used. MCU is needed to serialize a logic board after a logic board replacement and to configure the flash storage after new flash storage is installed. For instructions on how to use MCU, refer to article [TP1625: How to Use Mac Configuration Utility](#) and service video [SV369: System Configuration after a Logic Board or Flash Storage Repair](#).
- The flash storage devices are paired to the logic board and the data cannot be accessed or recovered when installed in another logic board. Make sure the customer has a working backup of their data before removing or replacing the flash storage devices. Refer to article [HT201250: How to use Time Machine to back up or restore your Mac](#).
- By default, security features keep the iMac Pro (2017) from being able to NetBoot, without disabling security features. For instructions on how to boot to an external drive or another computer, refer to articles:
 - [HT202796: How to select a different startup disk](#)
 - [HT208330: About Secure Boot](#)

- [HT208198: About Startup Security Utility](#)
- [HT202770: Create a NetBoot, NetInstall, or NetRestore image](#)
- [HT201462: How to use target disk mode to move files to another computer](#)
- Flash storage comes as a pair and must be replaced as a pair.
- If the power supply bus bars are damaged or bent they must be replaced.

Fixtures and Special Tools:

- Wireless card support tool (923-02218)
- Adjustable torque driver 0.3–1.2 Nm (923-0735)
- T8 security bit (923-0734)

Software updates:

iMac Pro (2017) ships with a model-specific version of macOS. Refer to article [HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version](#) to check that the system build is correct for this computer model. Using Software Update, check for and apply the latest software and firmware updates.

Serial Number Location

The serial number for the following iMac models is located on the bottom of the stand.

Note: If the computer has a VESA mount, then the serial number is located on the underside of the VESA mount tongue. The VESA mount for iMac Pro (2017) is customer installable.

- iMac (21.5-inch, Late 2012)
- iMac (27-inch, Late 2012)
- iMac (21.5-inch, Early 2013)
- iMac (21.5-inch, Late 2013)
- iMac (27-inch, Late 2013)
- iMac (21.5-inch, Mid 2014)
- iMac (Retina 5K, 27-inch, Late 2014)
- iMac (Retina 5K, 27-inch, Mid 2015)
- iMac (21.5-inch, Late 2015)
- iMac (Retina 4K, 21.5-inch, Late 2015)
- iMac (Retina 5K, 27-inch, Late 2015)
- iMac (21.5-inch, 2017)
- iMac (Retina 4K, 21.5-inch, 2017)
- iMac (Retina 5K, 27-inch, 2017)
- iMac Pro (2017)

When replacing the stand, use a fine-tip black permanent marker to neatly write the serial number on the bottom of the new stand.

Note: If replacing the VESA mount, then write the serial number on the underside of the replacement VESA mount tongue.



Input Devices

iMac Pro (2017) Input Devices

Space Gray Magic Trackpad 2



Space Gray Magic Mouse 2



Space Gray Magic Keyboard with Numeric Keypad



Features

- Pairs via Bluetooth or via Lightning connector
- Rechargeable embedded battery
- On/off switch
- Lightning connector

On/Off Switch

To turn on the Magic Trackpad 2 or Magic Keyboard, use the on/off switch (see 1 below) on the back of the device. This

switch is located on the bottom of the device for Magic Mouse 2. If green is visible inside the switch, then the device is turned on. There is no indicator light. **Note:** When Magic Keyboards are turned on and paired with a system, the Caps Lock LED will light up when Caps Lock is active.

Lightning Connector

The Magic Trackpad 2 and Magic Keyboard can be used wirelessly or wired, by plugging into the Lightning connector (see 2 below). The Magic Mouse 2 must be disconnected from Lightning Connector to operate.

Space Gray Magic Trackpad 2 (back)



Space Gray Magic Keyboard with numeric Keypad (back)



Space Gray Magic Mouse 2 (bottom)



Pair the device:

- The device will automatically pair when plugged in and turned on. Plug the device into a USB port on the computer and it will be detected.
- The device can also be paired wirelessly. Turn the device on, find the name in the Bluetooth preference pane, and click the name to pair.

Note: To check if the device is turned on, go to System Preferences > Bluetooth or click the Bluetooth icon in the menu bar. If the device is both turned on and paired with the computer, then it will show in bold.

Charge the device:

- Plug the device into a USB port on the computer using the Lightning cable.
- Plug the device into a 5W, 10W, or 12W Apple USB Power Adapter using the Lightning cable.

Note: The computer will show an alert when the battery is low. The battery level information can also be found by selecting the device in the Bluetooth menu in the menu bar.

General Troubleshooting

iMac Pro (2017) General Troubleshooting

Update Software and Firmware

Important: Make sure the iMac Pro (2017) is running the latest version of software and firmware. To check this, refer to article [HT201260: How to find the macOS version number on your Mac](#).

Troubleshooting Techniques

For more information, go to [ATLAS](#) and enter “troubleshooting” in the search field.

Hardware vs. Software

To isolate a hardware issue from a software issue, refer to article [HT203161: Isolating issues in macOS](#).

To troubleshoot a software issue, refer to the following articles:

- [HT201516: How to troubleshoot a software issue](#)
- [HT201861: About incompatible software on your Mac](#)
- [HT204323: If a flashing question mark appears when you start your Mac](#)
- [HT204904: How to reinstall macOS](#)

Additional References:

- [HT204267: If your Mac won't turn on](#)
- [HT204156: About the screens you see when your Mac starts up](#)
- [HT202179: About fans and fan noise in your Apple product](#)
- [HT204463: Fans run at full speed after computer turns on](#)

Power-On Self-Test (POST)

Intel-based Mac computers such as the iMac rely on a combination of tones and blinking LED lights to display Power-On Self-Test (POST) error codes.

- If the computer detects out-of-specification or no Random-Access Memory (RAM), the screen will remain black but the computer will beep. This error condition may be due to physically damaged RAM, installing an incorrect type of RAM, or not having RAM installed.
- Some RAM may appear to pass POST, but still cannot be used by the operating system. In this case, the computer will display a gray screen, sound three beeps and repeat beeps until computer is turned off.
- The solution to both of these situations is to first reseal RAM and test computer again. If RAM fails POST again, remove all installed RAM and test by installing one by one each RAM module that has been verified to work correctly on another computer ("known-good" RAM, for example) or order new RAM.
- A sequence of tones heard at startup or a no video symptom may also be fixed by temporarily removing/replacing the backup battery.

For more information, refer to articles:

- [HT202768: About Mac startup tones](#)
- [HT201702: About Mac Power On Self Test \(POST\) RAM error codes](#)
- [HT201255: Startup key combinations for Mac](#)

Quick Check Procedures

Resetting the System Management Controller (SMC)

The System Management Controller (SMC) is a chip on the logic board that controls all power functions. If the computer is experiencing any power issue, such as not starting up, not displaying video, sleep issues, or fan noise issues, resetting SMC may resolve it.

For more information and instructions to reset the SMC on different computer models, refer to article [HT201295: How to reset the System Management Controller \(SMC\) on your Mac](#).

Note for iMacs: If the power button is pressed while inserting the power cord, the iMac will enter a mode in which the fans run at full speed. For more information, refer to article [HT204463: Fans run at full speed after computer turns on](#).

Note for iMac Pro (2017): If the power button is pressed while inserting the power cord, the iMac will enter DFU mode and will need to be restored.

Resetting Non-Volatile RAM (NVRAM)

NVRAM stores certain system and device settings in a location that macOS can access quickly. Exactly which settings are stored in the computer's NVRAM varies depending on the type of computer as well as the types of devices and drives connected. To reset NVRAM:

1. Shut down the computer.
2. Locate the following keys on the keyboard: Command, Option (Alt), P, and R. You will need to hold these keys down simultaneously in Step 4.
3. Press power button.
4. Immediately press and hold Command-Option-P-R keys.
Important: You must press this key combination before the gray screen appears.
5. Hold down keys until computer restarts, and you hear startup chime a second time.
Note: For MacBook Pro (Late 2016 and 2017) and MacBook (Retina, 12-inch, 2017), hold down keys for at least 20 seconds. There is no startup chime.
6. Release keys.

Note: After resetting NVRAM, you might need to reconfigure settings for speaker volume, screen resolution, startup disk selection, and time zone information.

For more information, refer to article [HT204063: How to Reset NVRAM on your Mac](#).

Starting Up in Safe Mode

Safe mode (sometimes called safe boot) is a way to start up a Mac so that it performs certain checks and prevents some software from automatically loading or opening. These changes can help resolve or isolate certain issues on the startup disk.

Follow these steps to start up into safe mode:

1. Be sure the computer is shut down.
2. Press the power button.
3. Press and hold the Shift key.
Note: The Shift key should be pressed as soon as possible after the power button is pressed.
4. Release the Shift key when you see the Apple logo appear on the screen. After the Apple logo appears, it may take longer than usual to reach the login screen. This is because the computer is performing a directory check as part of safe mode.
5. To leave safe mode, restart the computer without pressing any keys during startup.

For more information, refer to article [HT201262: Use safe mode to isolate issues with your Mac](#).

Recovering a Lost Firmware Password

Only Apple Retail Stores or Apple Authorized Service Providers can unlock the following Mac models when protected by a firmware password:

- iMac (Mid 2011 and later)
- iMac Pro (2017)
- MacBook (Retina, 12-inch, Early 2015 and later)
- MacBook Air (Late 2010 and later)
- MacBook Pro (Early 2011 and later)
- Mac mini (Mid 2011 and later)
- Mac Pro (Late 2013)

Refer to the technician instructions in article [HT204455: How to set a firmware password on your Mac](#).

Diagnostic Software

Diagnostic Software for iMac Pro (2017)

Apple Service Toolkit 2 (AST 2)

AST 2 is a cloud-based diagnostic system to help technicians triage and verify repairs for Mac computers, starting with Mid 2014 models, except for MacBook Pro (Retina, Mid 2014). With AST 2, technicians are able to initiate diagnostics wirelessly on a user's device using Diagnostic Console (a web application on a Mac or iPad). Technicians are also able to view diagnostic results in Diagnostic Console.

For more information, refer to the following articles:

- [OP476: Latest Apple Service Toolkit download links and documentation](#)
- [TP1105: AST 2 for Mac Reference Guide - Table of Contents](#)
- [TP1118: AST 2 for Mac Reference Guide - Table of Contents \(Retail\)](#)
- [HT202731: How to use Apple Diagnostics on your Mac](#)

Thermal Sensors

SMC Name	Location	General Description (Degrees C)	Repair Suggestion
TA0p	Logic board ambient temperature	Logic board bottom / front side, near AC inlet	Excessive ambient temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
TB0p	Backlight controller proximity temperature	Logic board top / back side, upper left edge	Excessive backlight controller temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
TC0p	CPU proximity temperature	Logic board bottom / front side, middle center edge	Excessive CPU temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
TC1p	CPU core voltage regulator proximity temperature, input side	Logic board bottom / front side, middle right edge	Excessive CPU temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
TC2p	CPU core voltage regulator proximity temperature, output side	Logic board bottom / front side, middle right edge	Excessive CPU temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
TCXc	CPU maximum package core PECL temperature	Logic board top / back side, on large CPU IC	Excessive CPU temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
TG0d	GPU die 0 temperature	Logic board top / back side, on large GPU IC	Excessive GPU temperature or logic board sensor is damaged or disconnected from SMC. Check logic board and I/O connectors and fan operation.
TG1d	GPU die 1 temperature	Logic board top / back side, on large GPU IC	Excessive GPU temperature or logic board sensor is damaged or disconnected from SMC. Check logic board and I/O connectors and fan operation.
TG2d	GPU die 2 temperature	Logic board top / back side, on large GPU IC	Excessive GPU temperature or logic board sensor is damaged or disconnected from SMC. Check logic board and I/O connectors and fan operation.
TG3d	GPU die 3 temperature	Logic board top / back side, on large GPU IC	Excessive GPU temperature or logic board sensor is damaged or disconnected from SMC. Check logic board and I/O connectors and fan operation.
TG1p	GPU proximity 1 temperature	Logic board top / back side, near large GPU IC	Excessive GPU temperature or logic board sensor is damaged or disconnected from SMC. Check logic board and I/O connectors and fan operation.
TG2p	GPU proximity 2 temperature	Logic board top / back side, near large GPU IC	Excessive GPU temperature or logic board sensor is damaged or disconnected from SMC. Check logic board and I/O connectors and fan operation.
TG3p	GPU proximity 3 temperature	Logic board top / back side, near large GPU IC	Excessive GPU temperature or logic board sensor is damaged or disconnected from SMC. Check logic board and I/O connectors and fan operation.
TH0a/b/c/d	SSD A (left) temperature	Logic board top / back side, on SSD A	Excessive flash memory temperature or sensor is damaged or disconnected from SMC. Check SSD connectors and fan operation.

TH1a/b/c/d	SSD B (right) temperature	Logic board top / back side, on SSD B	Excessive flash memory temperature or sensor is damaged or disconnected from SMC. Check SSD connectors and fan operation.
TI0d	Thunderbolt proximity temperature	Logic board bottom / front side, near SSD A	Excessive Thunderbolt temperature or sensor is damaged or disconnected from SMC. Check SSD connectors and fan operation.
TI1d	Thunderbolt die temperature	Logic board top / back side, near bottom-right DIMM socket	Excessive Thunderbolt temperature or sensor is damaged or disconnected from SMC. Check SSD connectors and fan operation.
TI0p	10GB Ethernet proximity temperature	Logic board top / back side, near Ethernet RJ-45 connector	Excessive Ethernet temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
TI1p	USB-C 5V G3S voltage regulator temperature	Logic board top / back side, near bottom-right DIMM socket	Excessive USB-C temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
TI2d	Ethernet temperature	Logic board top / back side, near Ethernet RJ-45 connector	Excessive Ethernet temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
TL0p	Display temperature	LCD panel, back	Excessive display temperature or sensor is damaged or disconnected from SMC. Check logic board and display connectors and fan operation.
TL1p	TCON temperature	LCD panel, back	Excessive display temperature or sensor is damaged or disconnected from SMC. Check logic board and display connectors and fan operation.
TM0p	DIMM proximity 0 temperature	Logic board top / back side, near right side of lower DIMM sockets	Excessive memory temperature or sensor is damaged or disconnected from SMC. Check memory connectors and fan operation.
TM1p	DIMM proximity 1 temperature	Logic board top / back side, near left side of lower DIMM sockets	Excessive memory temperature or sensor is damaged or disconnected from SMC. Check memory connectors and fan operation.
TM2p	DIMM proximity 2 temperature	Logic board top / back side, near right side of upper DIMM sockets	Excessive memory temperature or sensor is damaged or disconnected from SMC. Check memory connectors and fan operation.
TM3p	DIMM proximity 3 temperature	Logic board top / back side, near left side of upper DIMM sockets	Excessive memory temperature or sensor is damaged or disconnected from SMC. Check memory connectors and fan operation.
Tm0p	MLB proximity 0 temperature	Logic board bottom / front side, middle-right, near heat sink	Excessive logic board temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
Tm1p	MLB proximity 1 temperature	Logic board top / back side, upper-left, near power supply bus bars	Excessive logic board temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
Tm2p	MLB proximity 2 temperature	Logic board bottom / front side, lower-left, near SSD B	Excessive logic board temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
Tm3p	MLB proximity 3 temperature	Logic board bottom / front side, lower-left, near large GPU IC	Excessive logic board temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.
Tp2h	Power supply secondary heat sink temperature	Inside power supply	Excessive power supply temperature or sensor is damaged or disconnected from SMC. Check power supply connectors and fan operation.
TPCD	PCH Die temperature	Logic board bottom / front side, near SSD A, inside PCH IC	Excessive logic board temperature or logic board sensor is damaged or disconnected from SMC. Check logic board connectors and fan operation.

Electrical Sensor Table

SMC Name	Location	General Description	Units	Repair Suggestion
VC0C	Logic board	CPU core load-side voltage	Volts	Out of range CPU voltage was found or open signal to SMC. Check logic board connectors.
VD2R	Logic board	Power supply 12V to CPU voltage	Volts	Out of range power supply voltage to CPU. Check power supply connections to the logic board.
VG0C	Logic board	GPU core low-side voltage	Volts	Out of range GPU voltage was found or open signal to SMC. Check logic board connectors.
VG2R	Logic board	Power supply 12V to GPU voltage	Volts	Out of range power supply voltage to GPU. Check power supply connections to the logic board.
IB2R	Logic board	Backlight controller 12V current	Amperes	Out of range backlight current. Check connections from the display to the logic board.
IC0C	Logic board	CPU core low side IMON current	Amperes	Out of range CPU current was found or open signal to SMC. Check logic board connectors.
IC0I	Logic board	CPU I/O load-side current	Amperes	Out of range input/output current was found or open signal to SMC. Check any connected input/output devices and logic board connectors.
IC0S	Logic board	CPU system agent Load-side IMON current	Amperes	Out of range CPU current was found or open signal to SMC. Check logic board connectors.
IC2R	Logic board	CPU core and system agent high-side current	Amperes	Out of range CPU current was found or open signal to SMC. Check logic board connectors.
ID2M	Logic board	Power supply 12V to CPU current	Amperes	Out of range power supply current. Check power supply connections to the logic board.
ID2R	Logic board	Power supply 12V to system current	Amperes	Out of range power supply current. Check power supply connections to the logic board.
IG0C	Logic board	GPU core low-side IMON current	Amperes	Out of range GPU current was found or open signal to SMC. Check logic board connectors.
IG0M	Logic board	GPU memory controller low-side current	Amperes	Out of range GPU current was found or open signal to SMC. Check logic board connectors.
IG2A	Logic board	GPU AUX 12V high-side current	Amperes	Out of range GPU current was found or open signal to SMC. Check logic board connectors.
IG2R	Logic board	GPU 12V high-side current	Amperes	Out of range GPU current was found or open signal to SMC. Check logic board connectors.
IH02	Logic board	SSD A (left) 12V high-side current	Amperes	Out of range SSD current was found or open signal to SMC. Check flash storage logic board connectors.
IH0R	Logic board	SSD A (left) high-side current	Amperes	Out of range SSD current was found or open signal to SMC. Check flash storage logic board connectors.
IH12	Logic board	SSD B (right) 12V high-side current	Amperes	Out of range SSD current was found or open signal to SMC. Check flash storage logic board connectors.
IH1R	Logic board	SSD B (right) high-side current	Amperes	Out of range SSD current was found or open signal to SMC. Check flash storage logic board connectors.
IM0P	Logic board	Memory SPD channels 0-1 Load-side current	Amperes	Out of range memory current was found or open signal to SMC. Check memory connectors.
IM2P	Logic board	Memory SPD channels 2-3 Load-side current	Amperes	Out of range memory current was found or open signal to SMC. Check memory connectors.
IMLR	Logic board	DIMM VDDQ all-channels Load-side current	Amperes	Out of range memory current was found or open signal to SMC. Check memory connectors.
IR01	Logic board	CPU memory controller channels 0-1 load-side current	Amperes	Out of range CPU or memory current was found or open signal to SMC. Check logic board and memory connectors.
IR23	Logic board	CPU memory controller channels 2-3 load-side current	Amperes	Out of range CPU or memory current was found or open signal to SMC. Check logic board and memory connectors.
IUAR	Logic board	USB-A 5V G3S voltage regulator current	Amperes	Out of range input/output current was found or open signal to SMC. Check any connected USB-A input/output devices and logic board connectors.
IUCR	Logic board	USB-C 5V G3S voltage regulator current	Amperes	Out of range input/output current was found or open signal to SMC. Check any connected USB-C input/output devices and logic board connectors.

Testing the Panel Using the Display Extension Cable Kit

Testing the Panel Using the Display Extension Cable Kit for iMac (27-inch, Late 2012–2017) and iMac Pro (2017)

Use the display extension cable kit to:

- Test the system and/or panel before securing the panel to the very high bond (VHB) adhesive strips.
- Test the functionality of the panel's Embedded DisplayPort (eDP) cable.



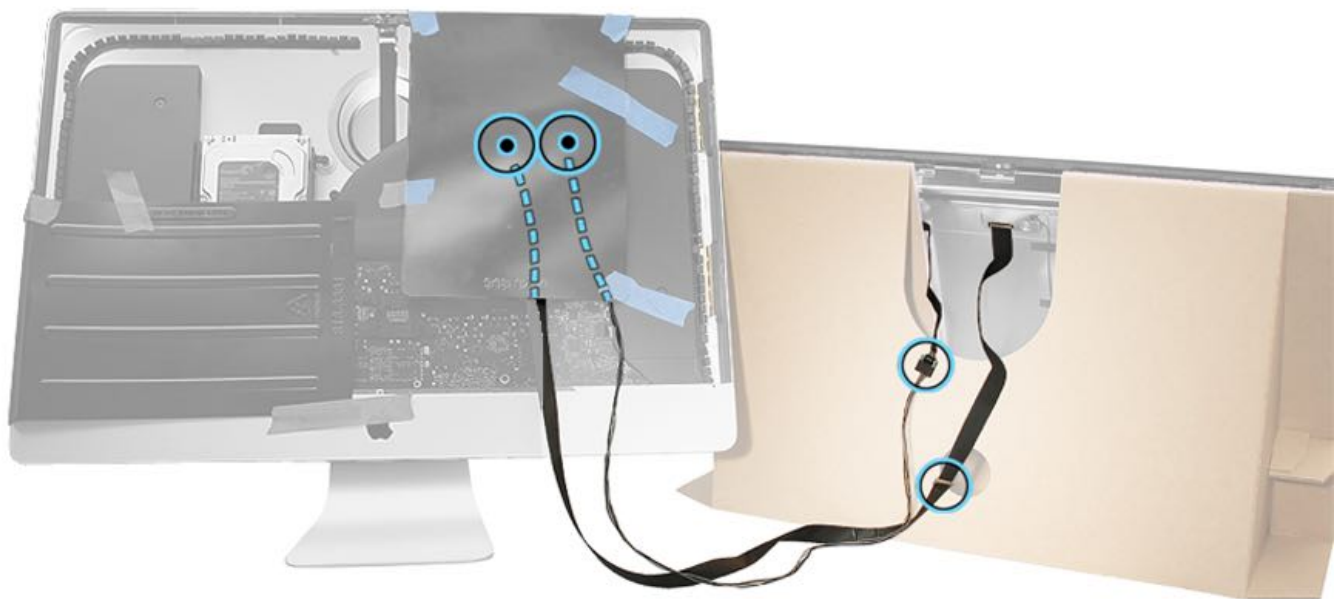
Warning: HIGH VOLTAGE. Use extreme caution when troubleshooting with the display panel removed. Avoid touching the logic board or power supply while the computer is plugged in, the power supply retains a charge whether or not the computer is on.

After unplugging the computer from the electrical outlet, wait two minutes before removing the display panel, disconnecting modules, or substituting cables and components. This will allow the power supply and logic board time to discharge.

- Never remove or install any physical components while the computer is plugged in to an electrical outlet.
- When plugged in, the power supply and logic board are energized, even when the computer is turned off.
- Unplug the computer and allow sufficient time for the power supply and logic board to self-discharge before removing the display panel.
- Do NOT touch the logic board or the power supply while the computer is plugged in, or before sufficient time has passed to discharge stored voltage to a safe level after being unplugged.

Refer to the following articles for more safety information:

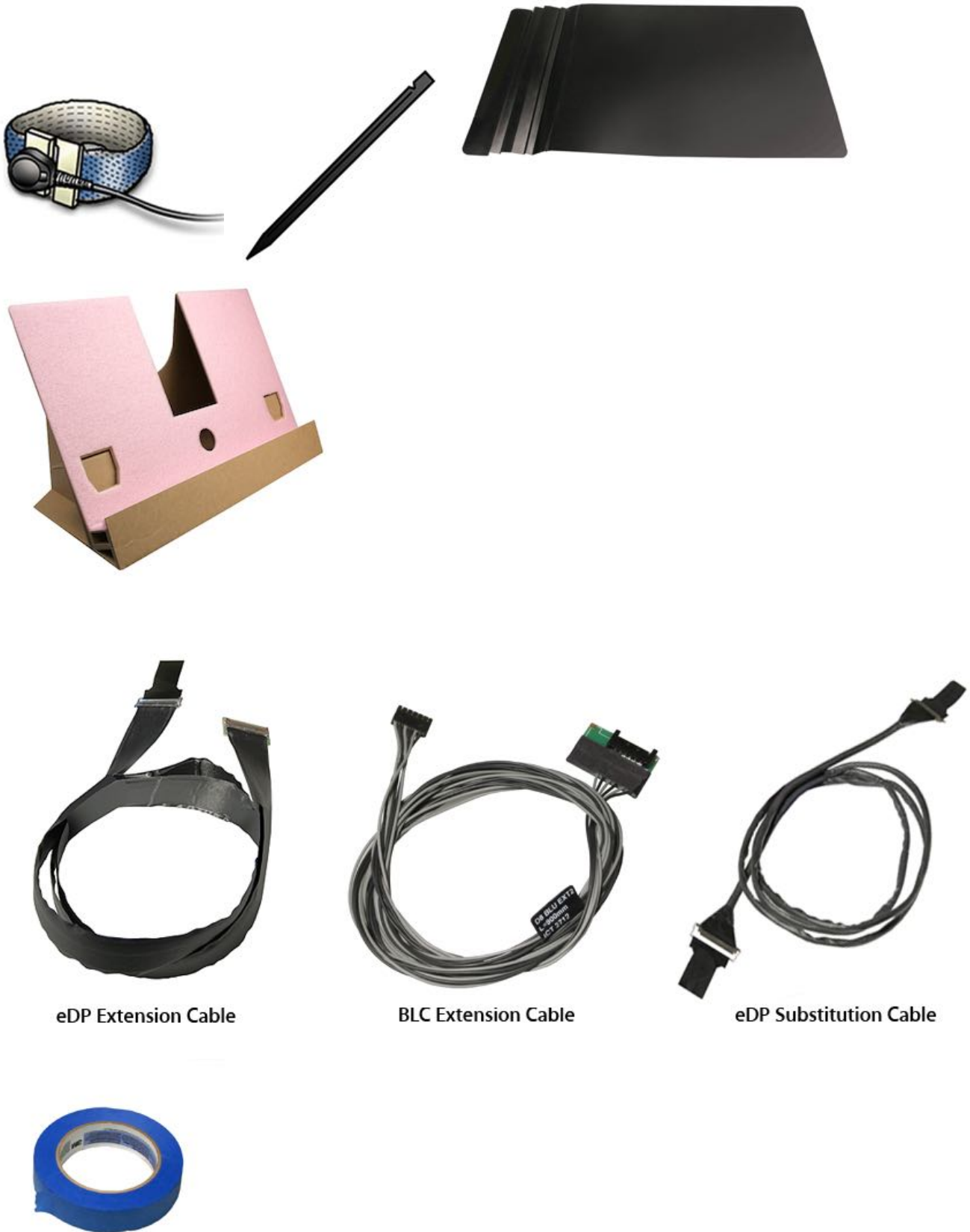
- [TP833: iMac and Displays: Power Supply Cover Instructions](#)
- [TP820: iMac \(27-inch\): Safety](#)
- [TP1620: iMac Pro \(2017\): Power Supply Cover Instructions](#)
- [TP1637: iMac Pro \(2017\): Safety](#)



Tools

- ESD wrist strap and mat
- Black stick
- Power supply protective covers, pack of two (923-0189)
- LCD service support stand, iMac (923-0416)
- Kit, display extension cable set (076-1431) for iMac (27-inch, Late 2012 and Late 2013)

- Kit, display extension cable set (076-00010) for iMac (Retina 5K, 27-inch, Late 2014–2017)
- Kit, display extension cable set (076-00373) for iMac Pro (2017)
- Painter's tape



Note: The iMac (27-inch, Late 2013) display and extension cable kit are shown for the procedures. Follow the same setup steps and procedures if testing the iMac (Retina 5K, 27-inch, Late 2014–2017) display or the iMac Pro (2017), but use the

correct kit for each.

- iMac (Retina 5K, 27-inch, Late 2014–2017): 076-00010
- iMac Pro (2017): 076-00373

Procedure #1: Testing the System With the Panel Off, Using Extension Cables

This procedure allows you to test the system with the panel off in order to ensure everything is functioning before securing the panel with very high bond (VHB) adhesive strips.

First Steps

For iMac (27-inch, Late 2012–2017):

- [Display panel removal](#)
- [Display panel - removing very high bond \(VHB\) strips](#)

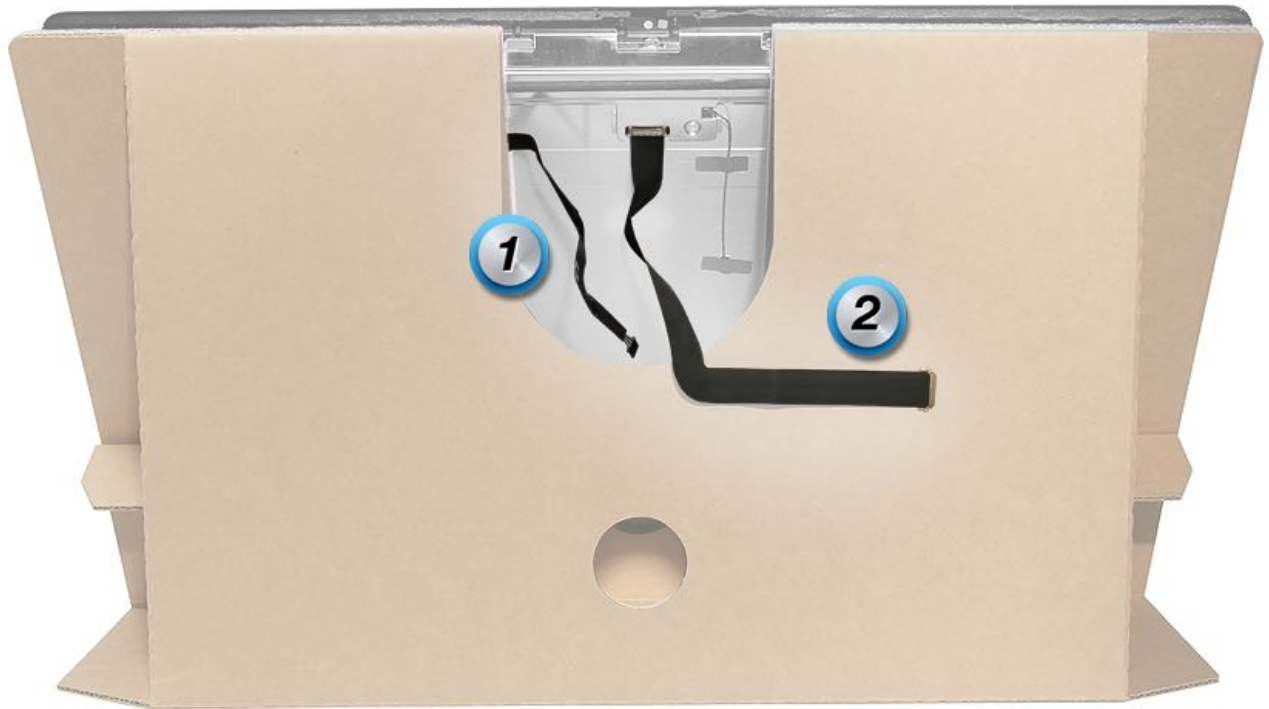
For iMac Pro (2017):

- [Display panel removal](#)
- [Display panel - removing very high bond \(VHB\) strips](#)

1. Place the LCD panel on the service support stand.



2. Orient the service support stand so the LCD backlight cable (#1) and eDP (#2) cable are facing you.



3. Locate the eDP extension cable in the kit.



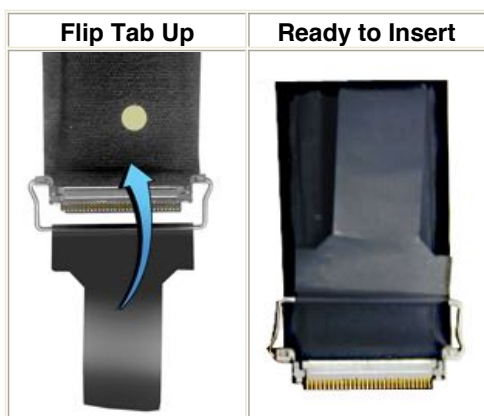
4. Either end of the eDP substitution cable can connect to the logic board; the other end connects to the display.

Important: Each end of the eDP extension cable has a gold dot to indicate cable orientation. Orient the cable with the gold dot side up when connecting the eDP extension cable to the logic board connector and the end of the LCD eDP cable. Connecting cables upside down (with the brass connector facing up) will damage the logic board and/or the LCD panel.

Note: With proper care, cables will last for approximately 50 insertions. After 50 insertions, cable degradation may occur and Apple recommends ordering a new Display Extension/Substitution Cable Kit (refer to the Tools section above).

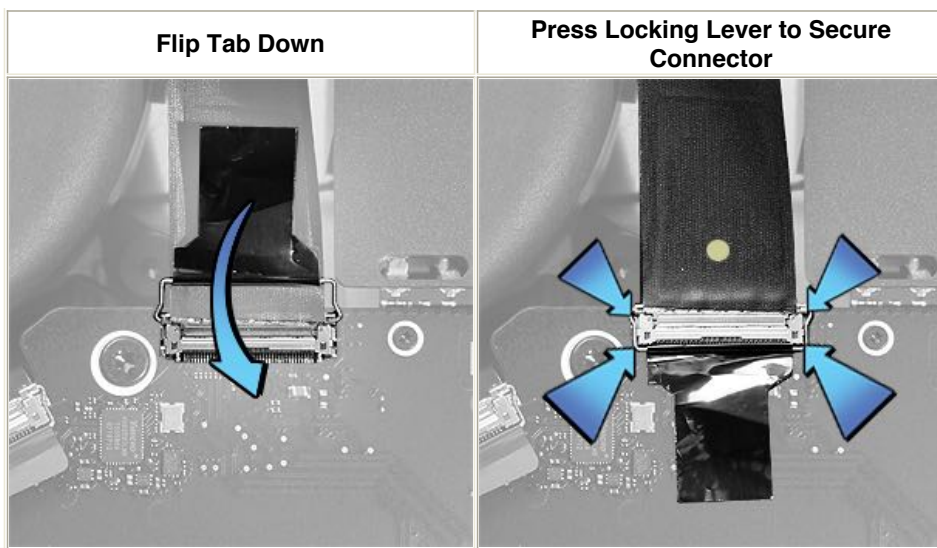


5. Flip the black tab up before connecting the eDP extension cable to the logic board connector.

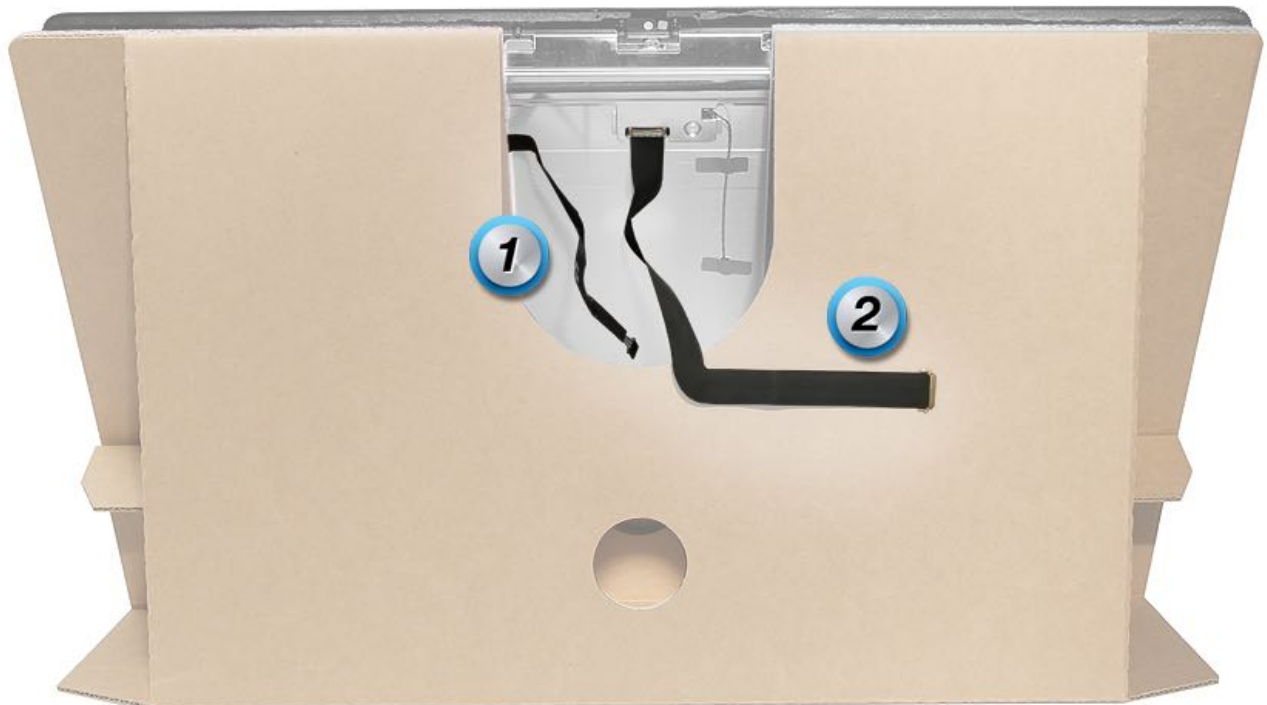


6. With the iMac unplugged, connect the extension cable to the logic board connector. The cable should be aligned straight on with the connector and never inserted at an angle. **Important:** Ensure that the black tab is attached to the locking lever on the eDP cable. Attaching the locking lever without the black tab may cause damage to the logic board and/or the LCD panel.

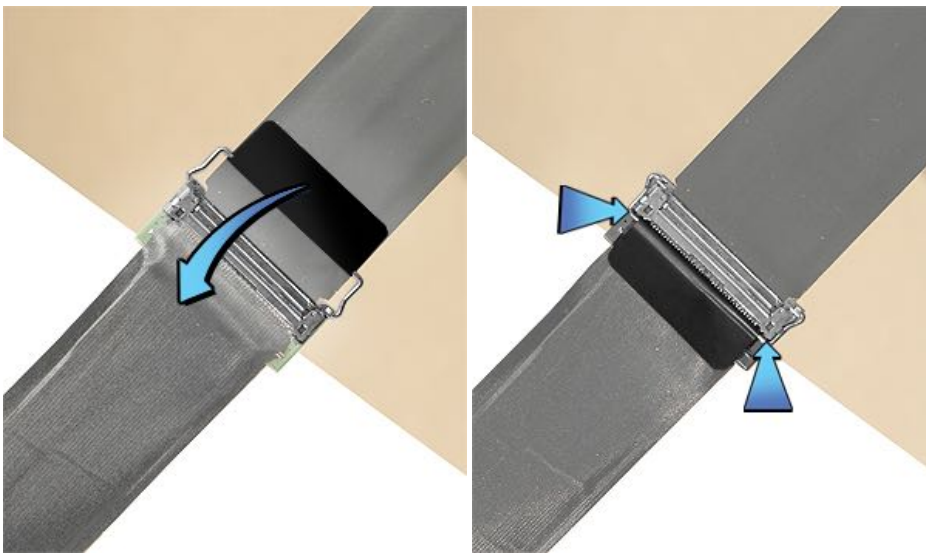
- Verify that each end of the cable has the gold dot side up.
- Check that the connector is fully seated.
- Flip the black tab down.
- Press the locking lever to secure the cable to the logic board.



7. Secure the logic board end of the eDP extension cable to the speaker with painter's tape (see step 10).
8. Connect the other end of the eDP extension cable to the end of the dangling DisplayPort cable (#2).



9. Securely mate the cable connectors. Flip the black tab over and press the locking lever bar around the connector to secure the cables.



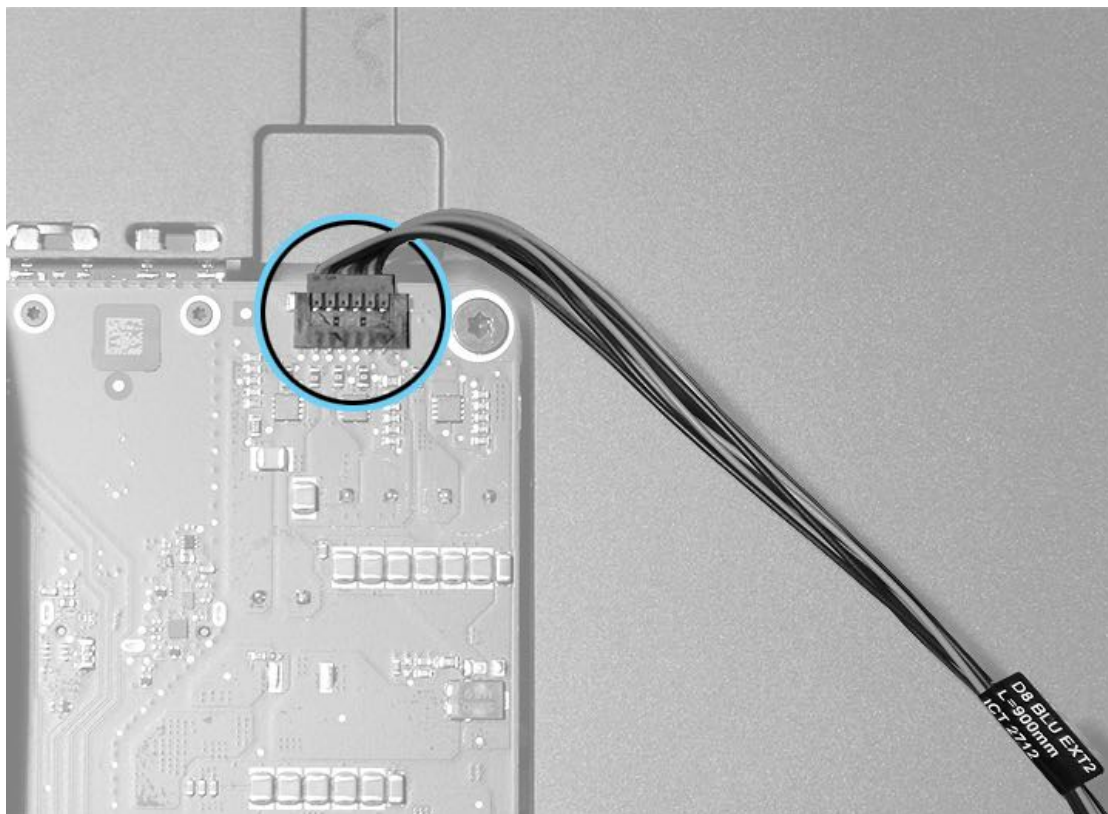
10. The eDP extension cable will look like the image below when connected properly.



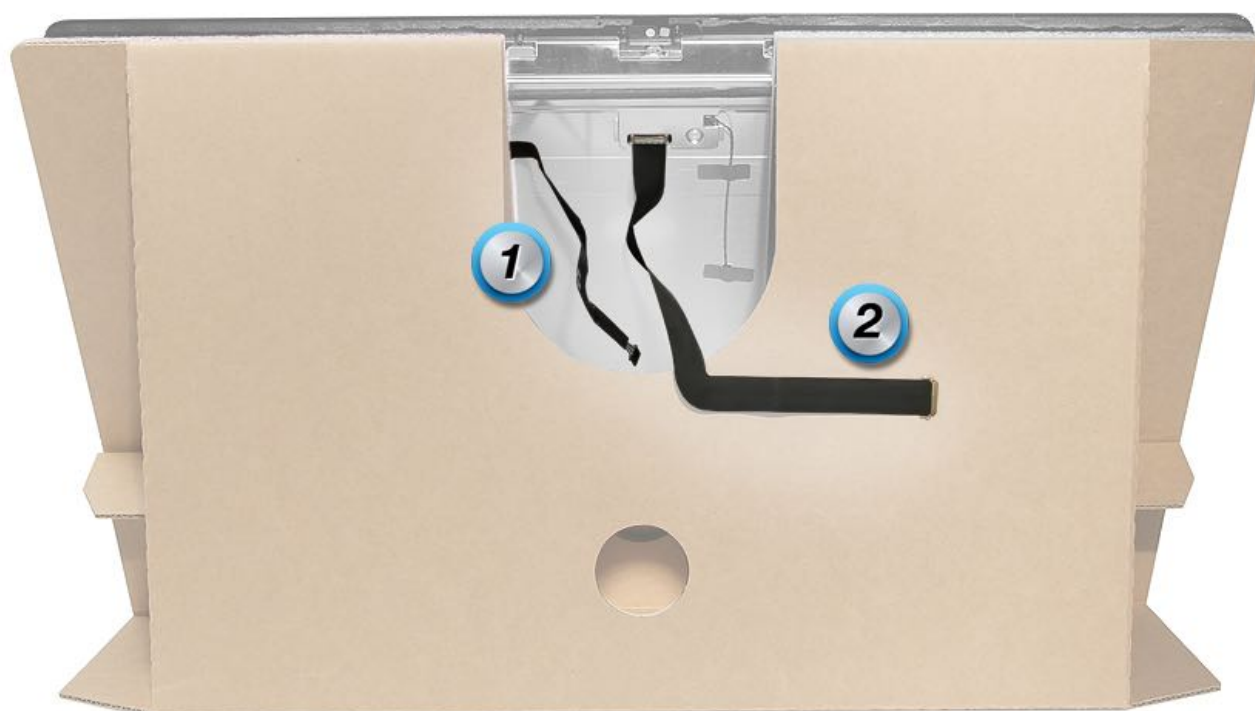
11. Next, locate the backlight extension (BLC) cable.



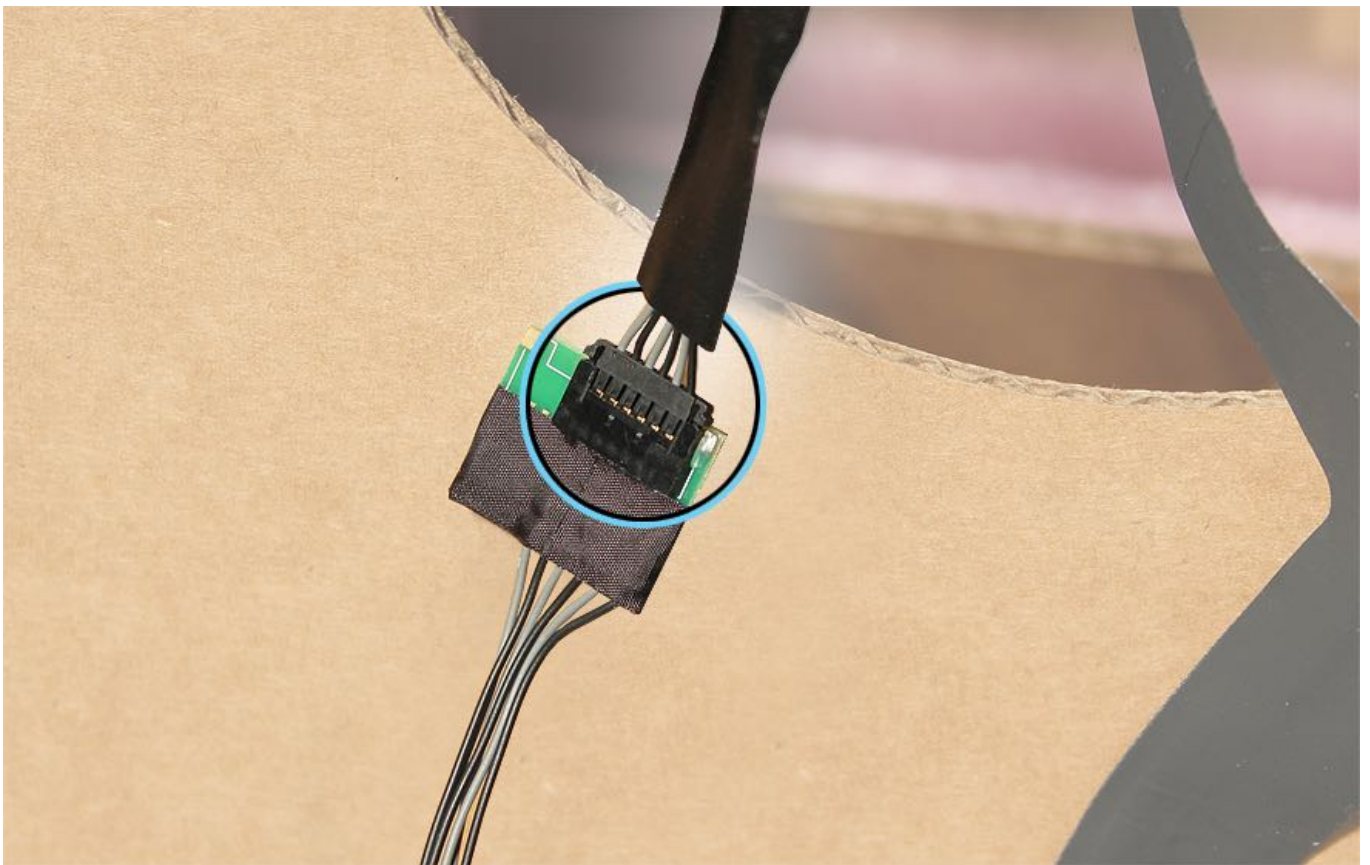
12. With the iMac unplugged, connect the backlight extension cable to the backlight connector on the logic board.



13. Connect the other end of the backlight extension cable to the dangling end of the LCD backlight cable (#1).

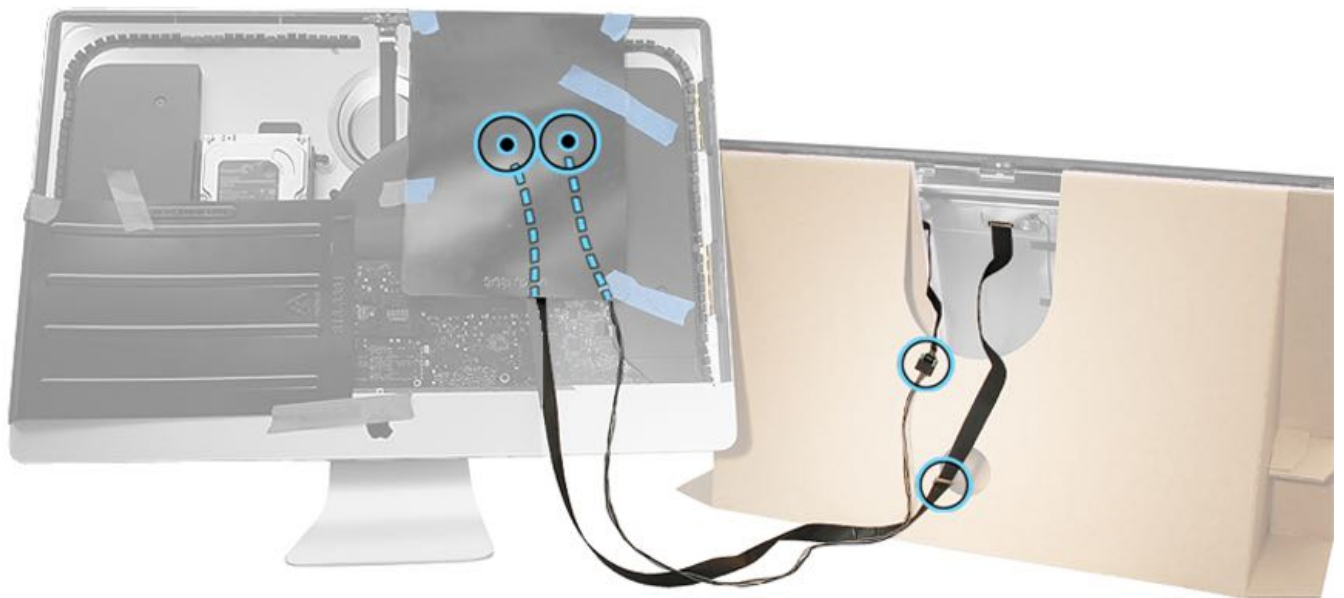


14. Securely mate the backlight extension cable with the panel's backlight cable connector.



15. Locate the two power supply covers. With the iMac unplugged, position one horizontally over the power supply and one vertically over the logic board and cables. Tape the power supply covers securely to the rear housing. Proper eDP and backlight extension cable setup is shown below.

16. Attach the power cord to the iMac and start up the system to verify system functionality.



Procedure #2: Testing the Panel with the eDP Substitution Cable

This procedure tests an eDP cable to determine whether the issue is with the eDP cable. Remove the “suspect” eDP cable from the circuit and replace it with the eDP substitution cable.

First Steps

For iMac (27-inch, Late 2012 – 2017):

- [Display panel removal](#)
- [Display panel - removing very high bond \(VHB\) strips](#)

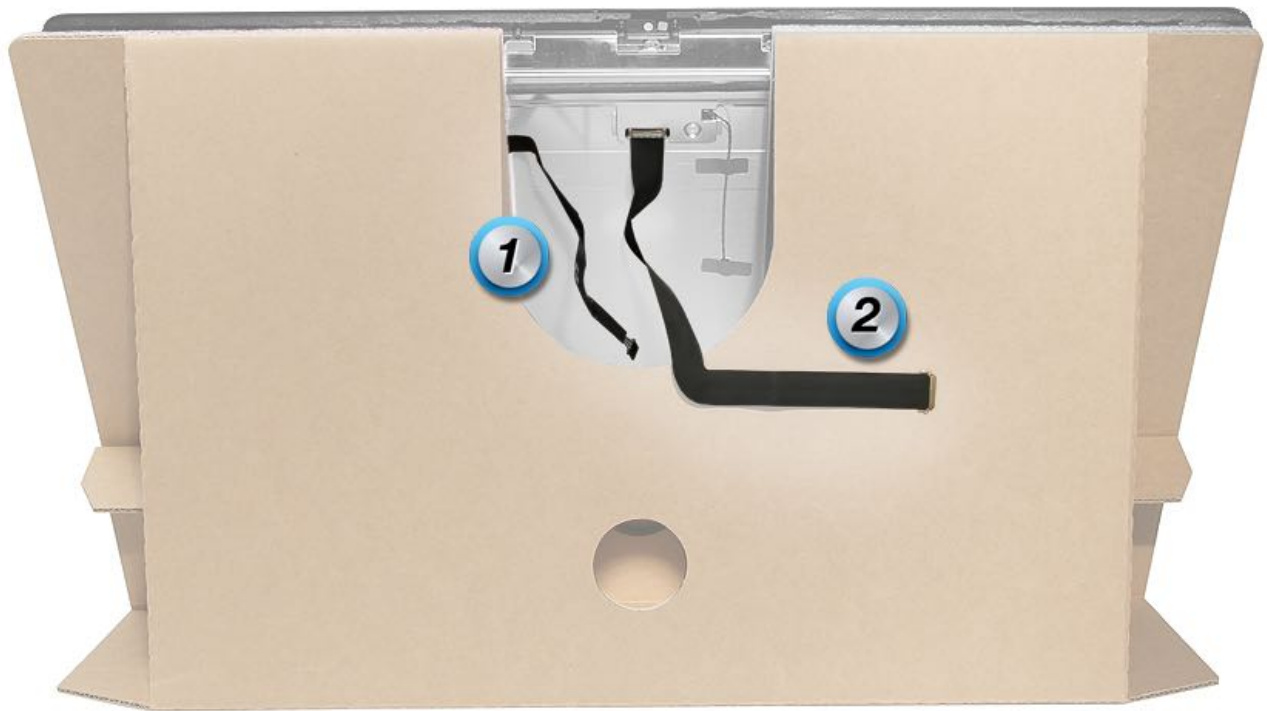
For iMac Pro (2017):

- [Display panel removal](#)
- [Display panel - removing very high bond \(VHB\) strips](#)

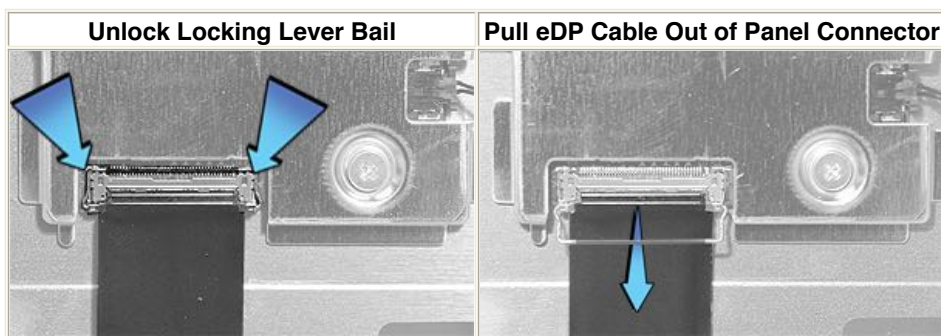
1. Place the LCD panel on the service support stand.



2. Orient the service support stand so the backlight cable (#1) and eDP (#2) cable are facing you.



3. Disconnect the eDP cable from the connector on the LCD panel. Use your fingernail to flip the locking lever bail. Pull the cable out of the connector.



4. Locate the eDP substitution cable.



5. Either end of the eDP substitution cable can connect to the logic board; the other end connects to the display.

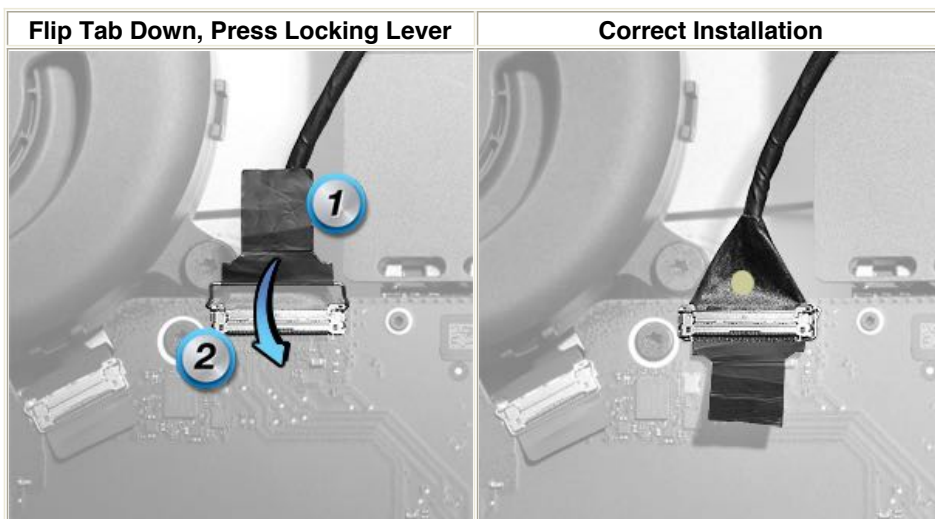
Important: Each end of the eDP substitution cable has a gold dot to indicate the cable orientation. Orient the cable with the gold dot side up when connecting the eDP substitution cable to the logic board and to the connector on the LCD panel. Connecting the cable upside down (with the brass connector facing you) will damage the logic board and/or the LCD panel.

Note: With proper care, cables will last for approximately 50 insertions. After 50 insertions, cable degradation may occur and Apple recommends ordering a new Display Extension/Substitution Cable Kit (refer to the Tools section above).



6. With the iMac unplugged, connect one end of the eDP substitution cable to the connector on the logic board. The cable should be aligned straight on with the connector and never inserted at an angle. The eDP substitution cable is shown properly connected to the logic board. **Important:** Ensure that the black tab is attached to the locking lever on the eDP cable. Attaching the locking lever without the black tab may cause damage to the logic board and/or the LCD panel.

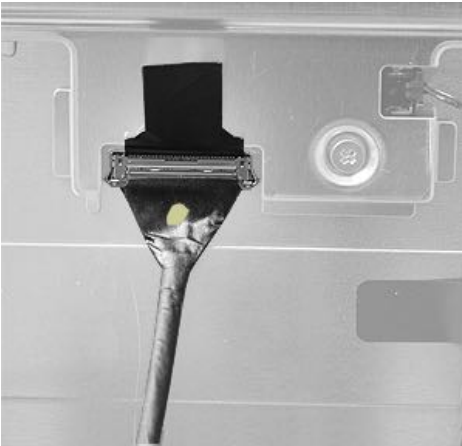
- Verify that each end of the cable has the gold dot side up.
- Check that the connector is fully seated.
- Flip the black tab down (#1).
- Press the locking lever (#2) to secure the cable to the logic board.



7. Connect the other end of the eDP substitution cable to the eDP connector on the back of the LCD panel.



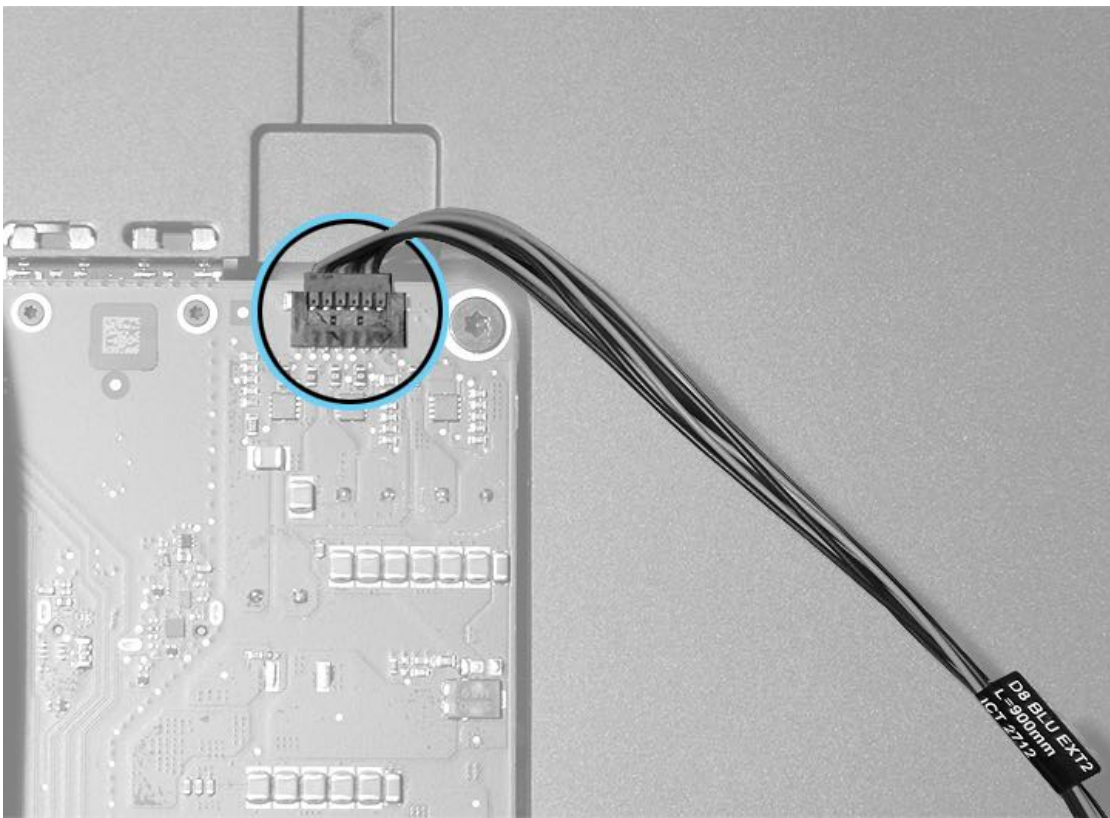
8. Flip the black tab up and press the locking lever bar to secure the cable to the connector on the panel.



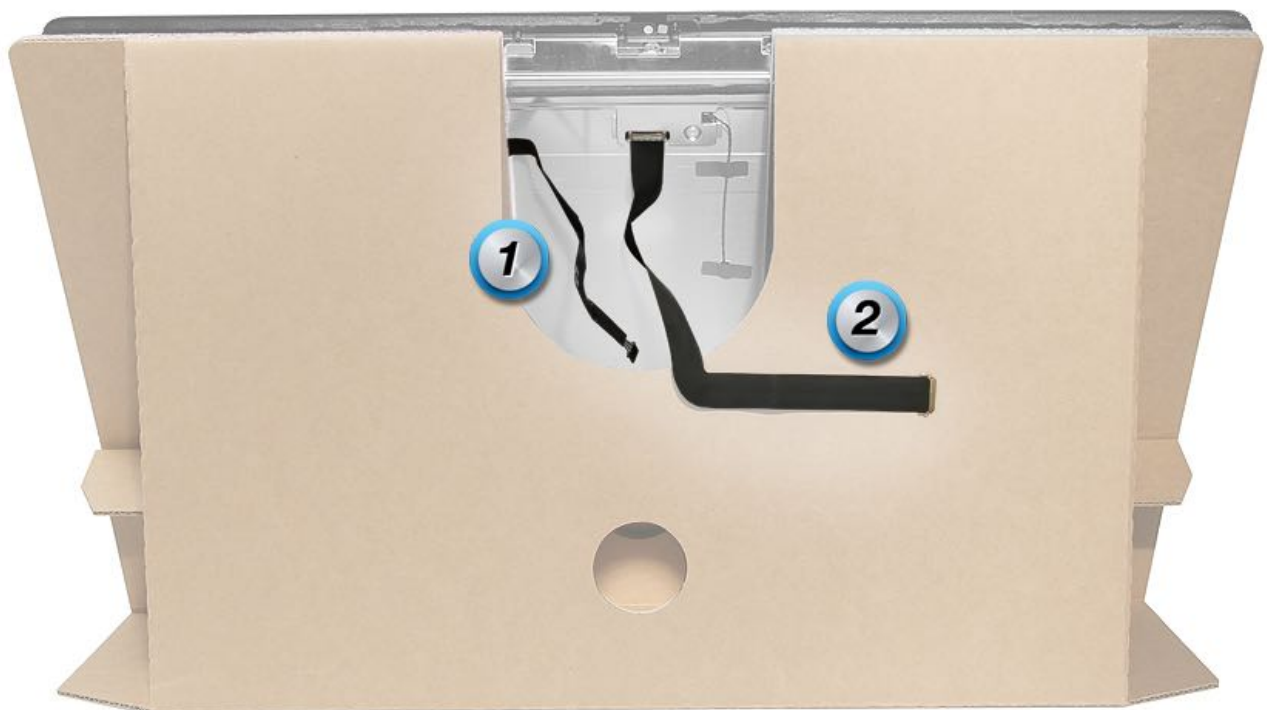
9. Locate the backlight extension cable (BLC).



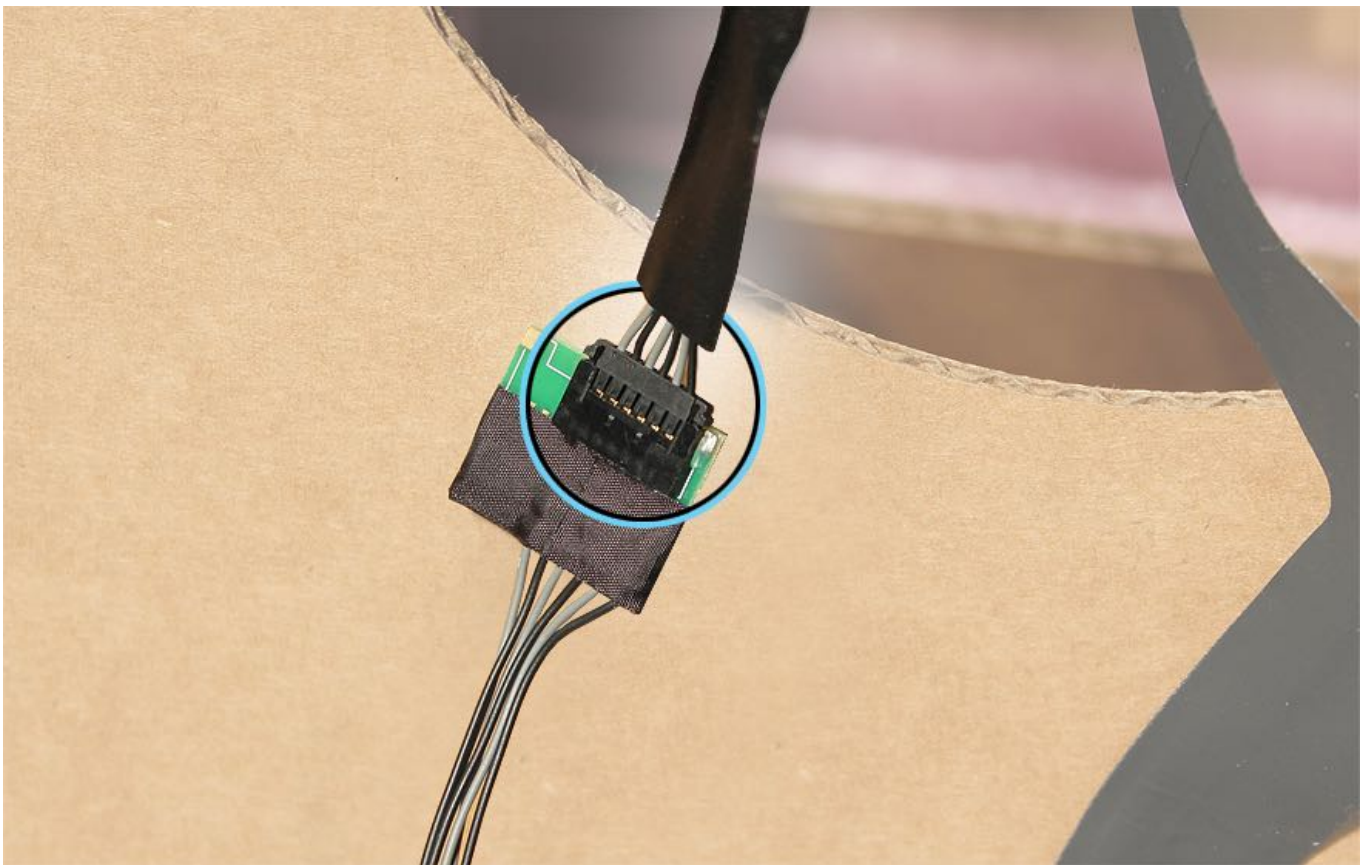
10. With the iMac unplugged, connect the backlight extension cable to the backlight connector on the logic board.



11. Connect the other end of the backlight extension cable to the dangling end of the LCD backlight cable (#1).

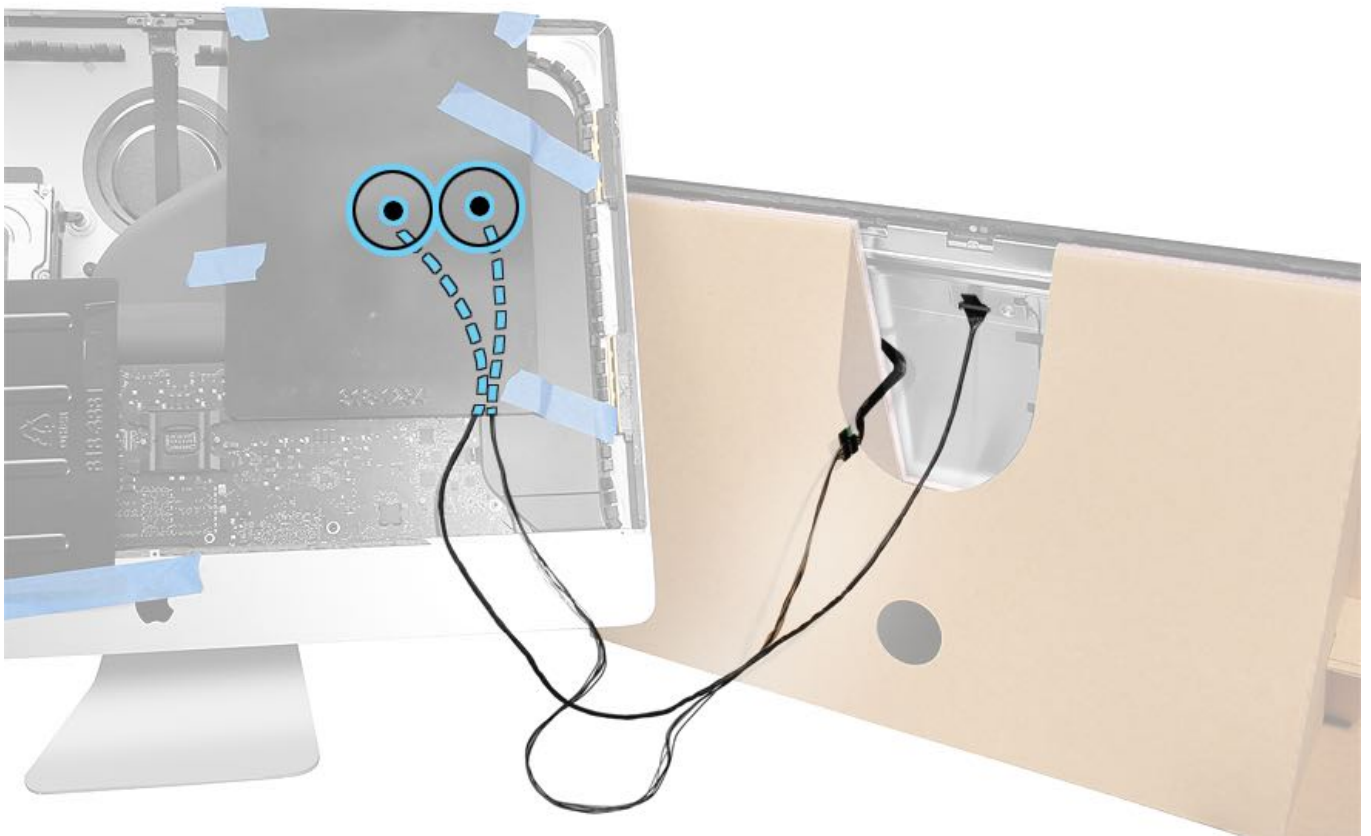


12. Securely mate the backlight extension cable with the panel's backlight cable connector.



13. Locate the two power supply covers. With the iMac unplugged, position one horizontally over the power supply and one vertically over the logic board and cables. Tape the power supply covers securely to the rear housing. The image below shows the proper cable setup for the eDP substitution cable and backlight extension cable.

14. Attach the power cord to the iMac and start up the system to verify eDP cable functionality.

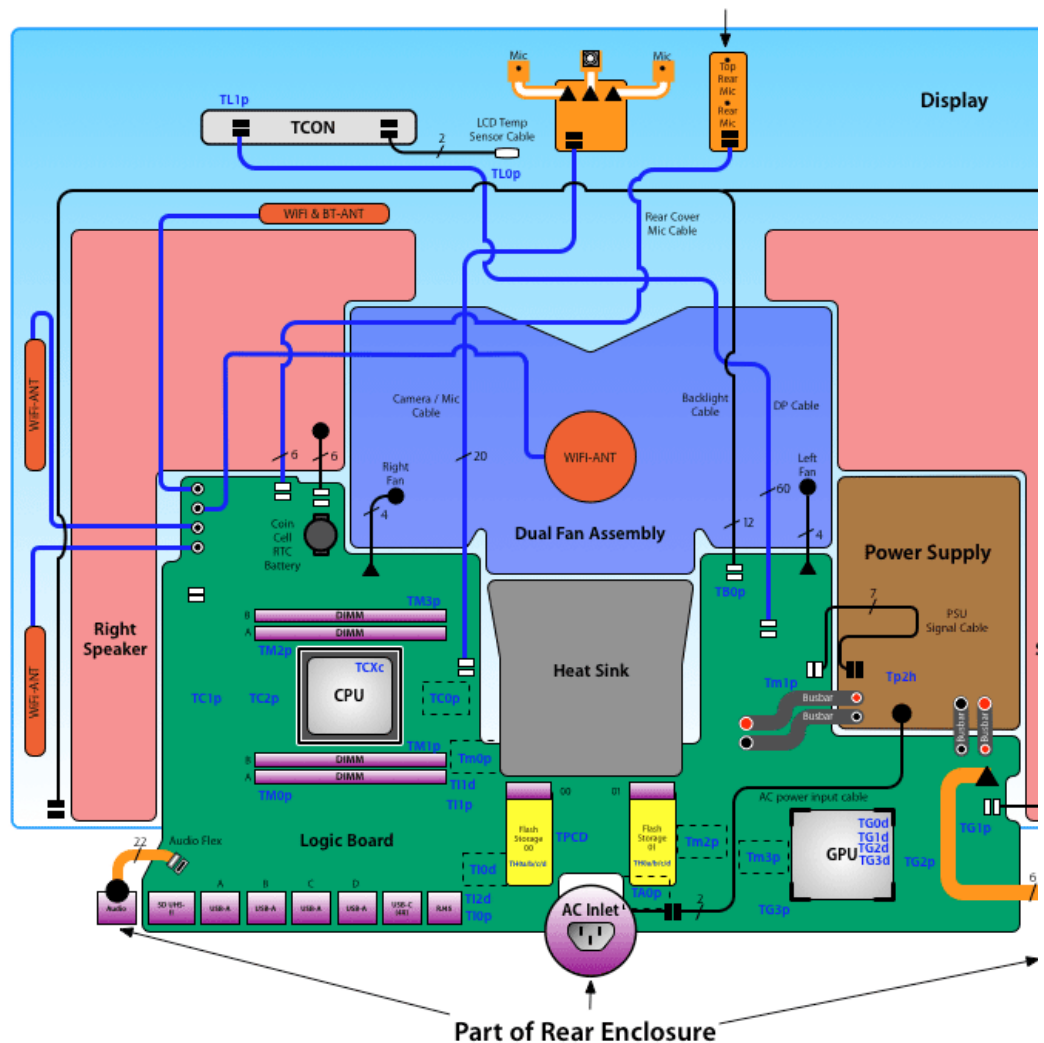


Interconnect Diagram

Interconnect Diagram for iMac Pro (2017)

Thermal sensors and cable connector locations are shown below.

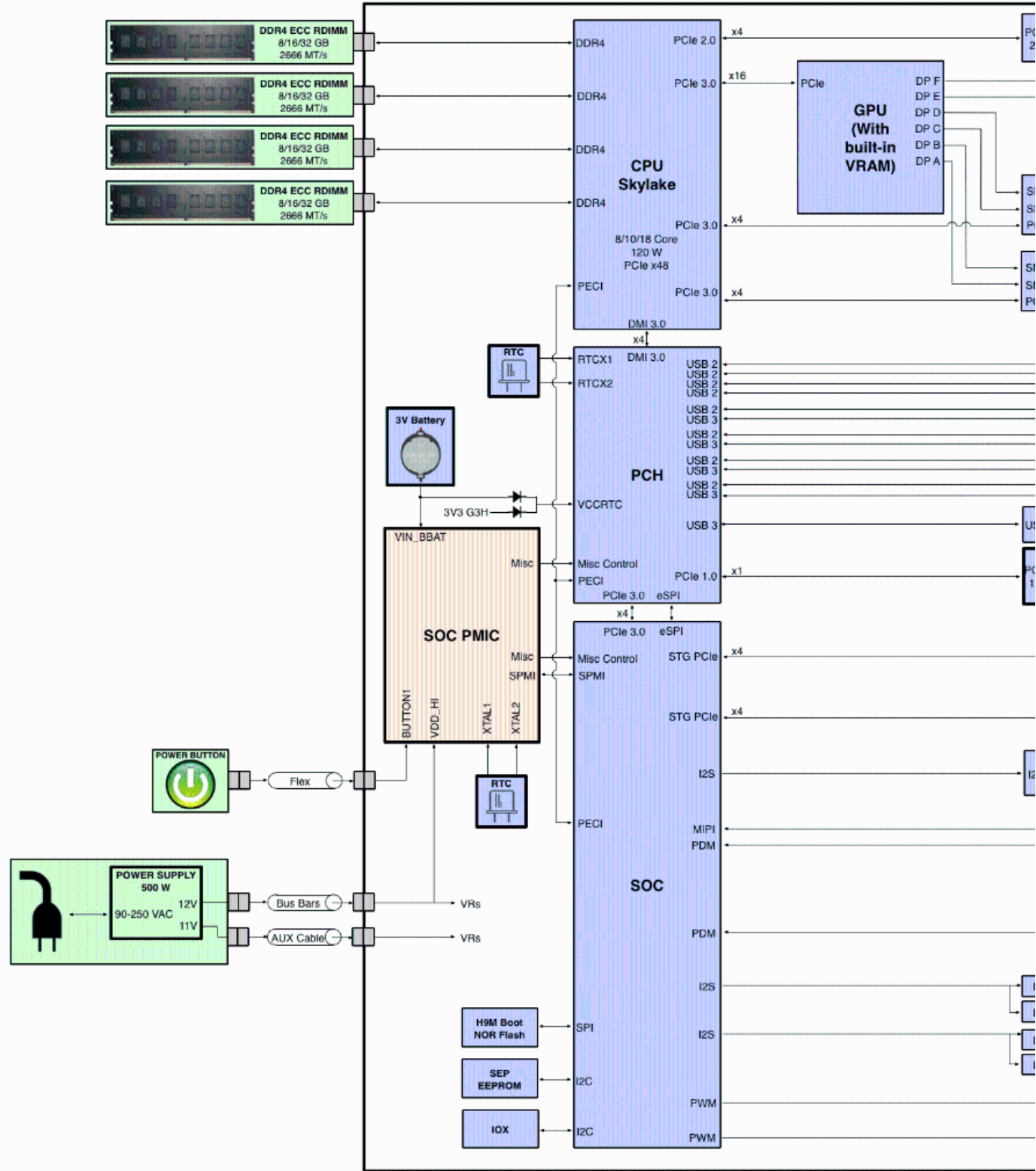
LEGEND	
	Flex
	Coax
	Wire
	ZIF top-side
	ZIF bottom-side
	LIF
	WTB top-side
	WTB bottom-side
	BTB (Rcpt)
	BTB (Plug)
	Card edge
	Board-in Conn
	Direct Solder
	WTB Circular Coax
	Custom Conn
/	# of Lanes/Wires
Tb0p	Temperature sensor (top-side)
Tl0p	Temperature sensor (bottom-side)



Block Diagram

Block Diagram for iMac Pro (2017)

Refer to this diagram to see how modules are interrelated.



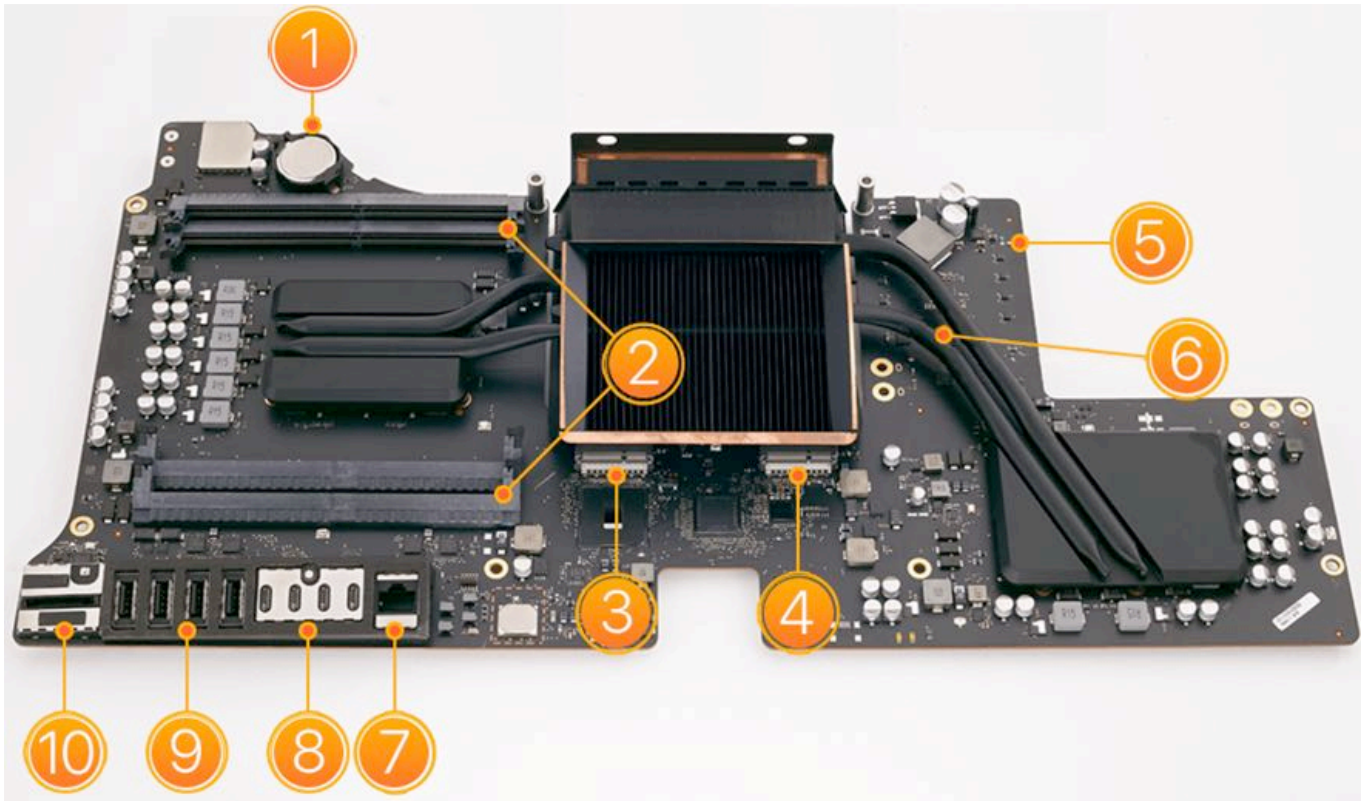
Functional Overview

Functional Overview for iMac Pro (2017)

For information on sensors and cable connections, refer to article [TP1617: Interconnect Diagram](#).

Back of Logic Board

Refer to this diagram for symptoms related to the connectors on the back of the logic board.



1 = Coin cell battery

- No power
- No video

2 = DIMM memory (4)

- Error beep tones on startup
- Freeze or kernel panic
- No boot

3 = Flash storage data and power (left connector A)

- No flash storage seen in System Info
- No boot from flash storage

4 = Flash storage data and power (right connector B)

- No flash storage seen in System Info
- No boot from flash storage

5 = Backlight fuse (FC600)

- No LED backlight on internal display

6 = Display fuse (FC500)

- No video but LED backlight on internal display

7 = Ethernet RJ-45

- No wired Ethernet connectivity
- Wired Ethernet data transfer issues

8 = Thunderbolt 3 (USB-C) ports (4)

- USB connectivity issues
- USB power issues
- No video to external display
- No audio to external display speakers
- Thunderbolt device not found
- Thunderbolt controller not recognized
- Thunderbolt driver issue
- Thunderbolt power issues

9 = USB 3 ports (4)

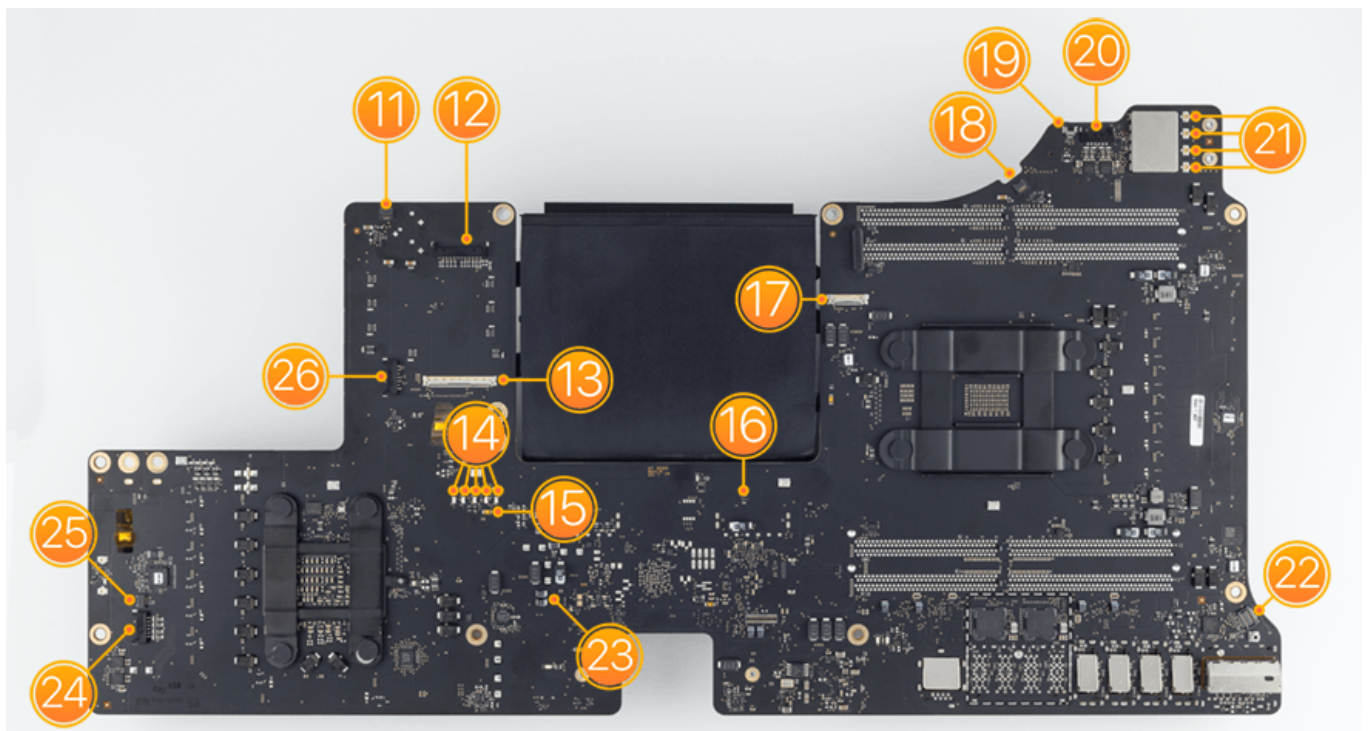
- USB connectivity issues
- USB power issues

10 = SDXC Card Slot

- No SD card seen in System Info
- Data transfer issues

Front of Logic Board

Refer to this diagram for symptoms related to connectors on the front of the logic board.



11 = Dual fan assembly, left

- System shuts down if fan is disconnected or blocked
- System freezes or kernel panics
- Noisy fan perception

12 = Display power (backlight control)

- No LED backlight on internal display
- Open backlight fuse F8100 on logic board

13 = Internal DisplayPort video

- No video, blurred, or monochrome video on internal display
- Open display fuse F4400 on logic board

14 = Diagnostic LEDs 1–5

- 1 = AC input voltage (trickle power present)
- 2 = Power supply DC output voltage
- 3 = Memory is functioning
- 4 = GPU is functioning
- 5 = Display panel is connected

15 = Diagnostic LED Button SL550

- Press this button to view diagnostic LEDs

16 = RTC reset pads (SP1802 & SP1803)

- Short across to reset Real Time Clock (RTC)

17 = Camera, camera LED, front microphones, and ambient light sensor (ALS)

- No camera function
- No LED when camera is on
- No or distorted internal microphone input (with Internal Microphone selected in Sound Input Preferences)

18 = Dual assembly fan, right

- System shuts down if fan is disconnected or blocked
- System freezes or kernel panics
- Noisy fan perception

19 = Rear microphone

- No or distorted internal microphone input (with Internal Microphone selected in Sound Input Preferences)

20 = Right speaker

- No sound from right speaker
- Distorted sound from right speaker

21 = Wireless antenna connectors

- Weak signal strength over Wi-Fi or Bluetooth
- Cannot connect to Wi-Fi networks or Bluetooth peripherals
- Slow Wi-Fi or Bluetooth connection speed

22 = Audio input/output

- No external analog audio input
- No external analog audio output
- No headset controls or mic input

23 = Backup battery test points (SP8100 and SP8101)

- Use to measure 3V DC backup battery coin voltage

24 = Left speaker

- No sound from left speaker
- Distorted sound from left speaker

25 = Power button

- No power

26 = Power on signal and power supply temperature sensor

- No power
- Intermittent shutdown (if cable is pinched or damaged)
- Fan runs at full speed

Bluetooth Device Connection Issues

Unlikely causes:

Battery, camera/microphone/ALS cable, fan, DisplayPort cable, display panel, left speaker, memory, power supply, rear enclosure, right speaker, flash storage card, stand

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Bluetooth cannot be enabledBluetooth is not detected or available in System InformationBluetooth can be turned on, but the computer is unable to pair with a known-good Bluetooth deviceIntermittent loss of communication with paired Bluetooth deviceData transfer over Bluetooth times out or is too slow <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">In System Preferences > Bluetooth, check that Bluetooth is on.Attempt to pair the computer with a known-good Bluetooth keyboard, mouse, or trackpad.Reset the Bluetooth device or delete the pairing (if applicable).Refer to HT201260: How to find the macOS version number on your Mac to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.If the customer is using a USB 3 device, review article HT201163: Using USB devices with your Mac to identify possible interference with Wi-Fi and Bluetooth communications if the device is positioned near their antennas.If the user's computer pairs Bluetooth normally at your service location, research potential sources of interference in the user's environment, such as microwave ovens or cordless phones in the 2.4/5GHz range. Refer to article HT201542: Potential sources of Wi-Fi and Bluetooth interference.Follow steps listed in HT204066: Use Bluetooth Diagnostics to help you isolate issues with wireless devices.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset SMC using the procedure listed for this computer in HT201295: How to reset the System Management Controller (SMC) on your Mac to return computer to a known power-off state. Try to turn on from power-off state. Do not hold in the power button when turning on the computer. You could inadvertently put the computer into DFU mode if you do. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">TP1620: iMac Pro (2017): Power Supply Cover InstructionsTP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodi
1.	<p>Run Mac Resource Inspector (MRI) or check System Information to verify that the wireless module is recognized.</p> <p>System Information:</p> <ul style="list-style-type: none"> Hardware > Bluetooth <p>Is Bluetooth service detected in MRI or System Information?</p>	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
		No	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M36	MLB
2.	<p>Open System Preferences > Bluetooth. Remove all paired devices. Pair the computer with a known-good Bluetooth device.</p> <p>Does the computer pair with a known-good Bluetooth device?</p>	Yes	Go to the "External Apple Bluetooth Peripherals" troubleshooting flow.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	
3.	<p>Follow steps listed in HT208198: About Boot Security Utility to enable starting up from an external storage device on the user's computer.</p> <p>Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT201260: How to find the macOS version number on your Mac.</p> <p>Connect to a known-good Bluetooth device. Compare Bluetooth performance and reliability to a known-good computer of similar type and Bluetooth specification.</p> <p>Is the pairing issue resolved and is Bluetooth performance as expected?</p>	Yes	<p>Reinstall macOS on the user's computer. Refer to HT201260: How to find the macOS version number on your Mac to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.</p>	`\${nodeText.yesSymptomCode}`	
		No	Go to step 4.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodi
4.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Locate the Bluetooth antenna, and inspect antenna's cable and connector for any damage.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p>	Yes	Go to step 5.	\${nodeText.yesSymptomCode}	
		No	Replace Bluetooth antenna. Verify issue resolved.	X03	OTHER ELECTRI
5.	<p>Are antenna cable and connector in good condition?</p> <p>Locate Bluetooth antenna port on logic board (top connector), and verify it is not damaged, loosened, or unsoldered.</p> <p>Note: Be sure to follow all service guide procedures and use the appropriate antenna removal tool and wireless card support tool when working with antenna cables. Failure to do so may result in logic board damage.</p> <p>Disconnect the Bluetooth antenna cable (top connector) from the logic board.</p> <p>Reseat antenna connector to logic board. Make sure connection is secure and correctly aligned.</p> <p>Is Bluetooth antenna connector port in good condition and securely seated?</p>	Yes	Go to step 6.	\${nodeText.yesSymptomCode}	
		No	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M36	MLB
6.	<p>Connect an external display and try to pair with a known-good Bluetooth device.</p> <p>Did computer pair successfully with known-good Bluetooth device?</p>	Yes	Issue resolved by reseating Bluetooth antenna. Verify resolution.	\${nodeText.yesSymptomCode}	
		No	Go to step 7.	\${nodeText.noSymptomCode}	
7.	<p>The Bluetooth antenna is located on upper edge of the enclosure and is available as a standalone part.</p> <p>Do you have immediate access to a known-good Bluetooth antenna?</p>	Yes	Go to step 8.	\${nodeText.yesSymptomCode}	
		No	Replace Bluetooth antenna. Verify issue resolved.	X03	OTHER ELECTRI

	Check	Result	Action	Code	Commodi
8.	<p>Substitute known-good (upper) Bluetooth antenna. Connect an external display and try to pair with a known-good Bluetooth device.</p> <p>Did computer pair successfully with known-good Bluetooth device?</p>	Yes	Replace Bluetooth antenna. Verify issue resolved.	X03	OTHER ELECTRI
		No	<p>Reinstall user's Bluetooth antenna. Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M36	MLB
9.	<p>Pair with a known-good Bluetooth device and verify that the connection is sustained for several minutes.</p> <p>Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	The issue is resolved.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

Ethernet Issues

Unlikely causes:

AirPort/Bluetooth antenna(s), battery, camera, camera/microphone/ALS cable or camera cable, CPU fan, DisplayPort cable, hard disk drive (HDD), hard drive data or power or combo cable, display panel, left speaker, memory, power supply, rear enclosure, right speaker, solid-state drive (SSD)/flash storage card, stand, wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• No Ethernet device present.• Unable to access Ethernet network resources.• Ethernet device shows no connection.• Ethernet device unable to get an IP address.• Slow Ethernet network performance. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Verify the network setup by accessing it directly via a known-good computer's Ethernet port.2. Launch System Information. Verify that the computer's Ethernet port appears in the Network devices tree.3. Test with known-good network hardware and an Ethernet cable (Cat-5 or better is recommended for 100+ Mbps connections).4. Using known-good network hardware and cable, start up from a known-good, up-to-date macOS volume. Go to Network Utility > Info and verify that Link Status is "Active."5. Check network settings. If a known-good DHCP server is available, set System Preferences > Network > Ethernet to Using DHCP. Verify the IP address. (If it begins with 169.x.x.x, the system was unable to get a valid IP address.)6. When started up from user's OS, revert to default network settings by creating a new location in System Preferences > Network.7. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure the system build is correct for this computer model. Check for and apply the latest software and firmware updates.8. Run AST 1 or AST 2 Mac Resource Inspector (MRI) and check results to verify that Ethernet hardware is detected.9. If AST 1 or AST 2 is not available, use System Information to verify that Ethernet hardware is recognized. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none">• TP1620: iMac Pro (2017): Power Supply Cover Instructions• TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect the Ethernet port for dust, debris, damage, or bent pins. Use compressed air to remove debris. Plug in a known-good Ethernet cable and make sure all pins make physical contact with connector. Are any Ethernet port pins damaged or insufficiently contacting the known-good Ethernet connector?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
2.	Inspect logic board, Ethernet port, and enclosure for dents, scratches, or other indications of impact or abuse. Does accidental damage appear to be cause of issue?	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
		No	Replace logic board. Verify issue resolved.	M10	MLB
3.	Inform user that computer failures due to accidental damage are not covered under any Apple warranty, including AppleCare. If applicable, discuss out-of-warranty repair options. Does user want to proceed with out-of-warranty repair?	Yes	Replace logic board. Verify issue resolved.	M10	MLB
		No	Issue resolved. Return computer to user using correct positioning.	\$(nodeText.noSymptomCode)	
4.	Ensure that the user's computer is connected to the Internet using a known-good Ethernet cable, and that Wi-Fi is turned off so that all network traffic goes through built-in Ethernet. Start up the computer using macOS Recovery or an up-to-date, bootable macOS volume. Hold down Command-R during startup to restart from the recovery partition. See articles HT201314: About macOS Recovery and HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version . Open Safari and attempt to access a known-good external web page such as www.apple.com to verify Ethernet connectivity. Look for the web page to load, or for a timeout indicating that the page did not load. Are Ethernet network resources accessible starting from recovery partition or a known-good OS?	Yes	Reinstall macOS on the user's computer. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	Go to step 5.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
5.	Restart the user's computer to the built-in macOS boot volume.	Yes	Go to step 6.	\$(nodeText.yesSymptomCode}	
	<p>In System Preferences > Network > Ethernet, verify that the link status is Connected (green dot) and that a valid IP address is listed. Connect the computer to an Ethernet network with a known-good DHCP server. Make sure static DHCP maps or filtering are not preventing address allocation.</p> <p>Note: DHCP allocation may not be instantaneous, depending on network. Retest.</p> <p>Is Ethernet link status active?</p>	No	Replace logic board. Verify issue resolved.	M10	MLB
6.	<p>Go to System Preferences > Network > Ethernet and obtain router IP address. Use Network Utility to ping router IP address. Use a simple hub/switch environment.</p> <p>Is Network Utility able to ping router IP address?</p>	Yes	No performance or connectivity issues detected. No repair necessary. The problem may be the network environment. Refer user to article TS1317: Troubleshooting a cable modem, DSL, or LAN Internet connection.	\$(nodeText.yesSymptomCode}	
		No	Go to step 7.	\$(nodeText.noSymptomCode}	
7.	<p>Perform network testing from previous step, using same cable and network, but with a known-good computer.</p> <p>Is network performance of user's computer inferior to known-good computer?</p>	Yes	Replace logic board. Verify issue resolved.	M10	MLB
		No	No performance or connectivity issues detected. No repair necessary. The problem may be the network environment. Refer user to article TS1317: Troubleshooting a cable modem, DSL, or LAN Internet connection.	\$(nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
8.	1. Connect Ethernet cable to a known-good network with a DHCP server. 2. In System Preferences > Network > Ethernet, verify link status is Connected (green dot). 3. Configure TCP/IP settings to Using DHCP and check that a valid IP address is obtained from server (not a self-assigned one starting with 169.x.x.x). 4. Launch web browser and verify that you can access websites and download files. Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is issue resolved?	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	M99	

Wi-Fi Connection Issues

Unlikely causes:

Battery, camera/microphone/ALS cable, DisplayPort cable, fan, flash storage card, display panel, left speaker, memory, power supply, right speaker, stand

Quick Check

Symptoms	Quick Check
----------	-------------

- Wi-Fi cannot be enabled
- Wi-Fi is not detected or available in System Information
- Unable to find or connect to wireless networks
- Slow or stalled data transfers
- Intermittent connection dropouts

Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.

On user's computer:

1. Refer to [HT201260: How to find the macOS version number on your Mac](#) to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.
2. Using Ethernet network interface, connect to Internet, then check for and apply latest software and firmware updates.
3. Start up computer using recovery partition or an up-to-date, bootable macOS volume, and attempt to connect to a wireless network.
4. On a known-good computer, go to System Preferences > Sharing and select Internet Sharing. Configure the known-good computer to "Share your connection from" > Ethernet and "To computers using" > Wi-Fi. Try to connect user's computer to the newly created wireless network.
5. Using a known-good OS and base station, compare Wi-Fi throughput in Activity Monitor > Network to that of a similar computer.
6. Refer to article [HT202663: Check for Wi-Fi issues using your Mac](#) to familiarize yourself with the macOS Wireless Diagnostic utility.
7. Reset the NVRAM using the procedure for this computer in article [HT204063: How to Reset NVRAM on your Mac](#).
8. Reset SMC using the procedure listed for this computer in [HT201295: How to reset the System Management Controller \(SMC\) on your Mac](#) to return computer to a known power-off state. Try to turn on from power-off state. Do not hold in the power button when turning on the computer. You could inadvertently put the computer into DFU mode if you do.

If the issue cannot be reproduced on site, prompt the user to check their Wi-Fi base station for the following:

1. Check for base station firmware updates.
2. Check for nearby interference sources in the 2.4/5GHz range such as microwave ovens and cordless phones. See article [HT201542: Potential sources of Wi-Fi and Bluetooth interference](#).
3. Make sure base station is not using MAC address filtering or has not created a hidden network.
4. Make sure base station is not set to low-power transmission mode.
5. Make sure base station is not using an unsupported connection and encryption protocol.
6. Check for Wi-Fi channel overlap (a nearby base station using an adjacent channel).
7. Connect to a known-good test network.
8. Test in a different environment.

Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.

Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.

For additional safety information and tips, refer to articles:

- [TP1620: iMac Pro \(2017\): Power Supply Cover Instructions](#)
- [TP1637: iMac Pro \(2017\): Safety](#)

Deep Dive

	Check	Result	Action	Code
1.	Run Mac Resource Inspector (MRI) or check System Information to verify that the wireless module is recognized. System Information: <ul style="list-style-type: none">Network > Wi-Fi Is Wi-Fi service detected in MRI or System Information?	Yes	Go to step 2.	\$(nodeText.yesSymptom
		No	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M35
2.	Run Wireless Diagnostics by holding down the Option key, clicking the wireless icon in the menu bar, and then choosing Open Wireless Diagnostics. Wireless Diagnostics can also be found at: /System/Library/CoreServices/Applications/Wireless Diagnostics.app Does the computer complete Wireless Diagnostics with no issues?	Yes	Go to step 3.	\$(nodeText.yesSymptom
		No	Go to step 4.	\$(nodeText.noSymptom
3.	Connect to a known-good wireless network and open Wireless Diagnostics > Window > Performance. Review the quality graph to evaluate the signal quality of the wireless connection. Verify that the signal is good or excellent, and that the transmission rate (Tx Rate) is comparable to another known-good computer of similar type and Wi-Fi specification. Where available, switch between 2.4GHz and 5GHz networks to verify that the signal quality is comparable to a known-good computer. Using a network with a high transmission rate, download a large file from a known-good website or file server. Compare network performance to another known-good computer of similar type and Wi-Fi specification. Verify throughput using Activity Monitor > Network. Are the performance and throughput comparable between the user's computer and a known-good computer?	Yes	Wi-Fi performance is within specification. Verify that the issue is resolved.	\$(nodeText.yesSymptom
		No	Go to step 4.	\$(nodeText.noSymptom
4.	Follow steps listed in HT208198: About Boot Security Utility to enable starting up from an external storage device on the user's computer. Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT201260: How to find the macOS version number on your Mac . Attempt to reproduce the Wi-Fi performance or connection issue. Does issue persist with known-good OS?	Yes	Go to step 5.	\$(nodeText.yesSymptom
		No	Reinstall macOS on the user's computer. Refer to HT201260: How to find the macOS version number on your Mac to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	\$(nodeText.noSymptom
5.	Turn off Bluetooth to eliminate potential interference. Check for other interference such as microwave ovens or cordless phones. See article HT201542: Potential sources of Wi-Fi and Bluetooth interference . Change base station channel. Does the issue persist?	Yes	Go to step 6.	\$(nodeText.yesSymptom
		No	Issue caused by interference. Remove sources of interference, or use a different Wi-Fi channel or mode (2.4GHz or 5GHz). Verify issue resolved.	\$(nodeText.noSymptom

	Check	Result	Action	Code
6.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Locate the three Wi-Fi antennas and inspect each antenna's cable and connector for any damage.</p> <p>Are Wi-Fi antenna cables and connectors in good condition?</p>	Yes	Go to step 8.	\$(nodeText.yesSymptom)
		No	Go to step 7.	\$(nodeText.noSymptom)
7.	<p>Verify whether affected Wi-Fi antenna is available separately as a service part.</p> <p>Is Wi-Fi antenna available as service part?</p>	Yes	Replace affected Wi-Fi antenna. Verify issue resolved.	X03
		No	<p>ESCALATION REQUIRED.</p> <p>The antenna is part of the rear housing. Replace the rear housing. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	X99

	Check	Result	Action	Code
8.	<p>Locate Wi-Fi antenna connector ports on logic board (bottom three connectors) and verify that they are not damaged, loosened, or unsoldered.</p> <p>Note: Be sure to follow all service guide procedures and use the appropriate antenna removal tool and wireless card support tool when working with antenna cables. Failure to do so may result in logic board damage.</p> <p>Disconnect the Wi-Fi antenna cables (bottom three connectors) from the logic board.</p> <p>Reseat antenna connectors to logic board. Make sure connections are secure and correctly aligned.</p> <p>Are Wi-Fi antenna connector ports in good condition and securely seated?</p>	Yes	Go to step 9.	\$(nodeText.yesSymptom
		No	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M35
9.	<p>To verify Wi-Fi performance and reliability, start up computer using an up-to-date, bootable macOS, 10.8.4 or later volume for access to Wireless Diagnostics application. See article HT202663: Check for Wi-Fi issues using your Mac to familiarize yourself with wireless diagnostic utilities.</p> <p>Connect to a known-good wireless network and open Wireless Diagnostics > Window > Performance. Review Quality and Rate graphs to evaluate signal of wireless connection. Verify signal is good or excellent and transmission rate (Tx Rate) is comparable to another known-good computer of similar type and Wi-Fi specification. Where available, switch between 2.4GHz and 5GHz networks to verify signal quality is comparable to a known-good computer. Using a network with a high transmission rate, download a large file from a known-good website or file server. Compare network performance to another known-good computer of similar type and Wi-Fi specification. Verify throughput using Activity Monitor > Network.</p> <p>Are performance and throughput comparable between user's computer and a known-good computer?</p>	Yes	Wi-Fi performance is within specification. Verify issue resolved.	\$(nodeText.yesSymptom
		No	Go to step 10.	\$(nodeText.noSymptom
10.	<p>To troubleshoot this issue completely, a set of known-good Wi-Fi antennas is required.</p> <p>Note: Some Wi-Fi antennas are part of the rear housing and are not separately replaceable.</p> <p>Do you have immediate access to a set of known-good Wi-Fi antennas?</p>	Yes	Go to step 11.	\$(nodeText.yesSymptom
		No	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M35
11.	<p>Substitute known-good Wi-Fi antenna. Connect external display and retest, comparing performance and throughput of user's computer with known-good computer. Repeat with other antennas.</p> <p>Are performance and throughput comparable between computers?</p>	Yes	Go to step 12.	\$(nodeText.yesSymptom
		No	<p>Reinstall user's Wi-Fi antenna. Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M35

	Check	Result	Action	Code
12.	<p>Verify whether affected Wi-Fi antenna is available separately as a service part.</p> <p>Is Wi-Fi antenna available as service part?</p>	Yes	Replace affected Wi-Fi antenna. Verify issue resolved.	X03
		No	<p>ESCALATION REQUIRED.</p> <p>The antenna is part of the rear housing. Replace the rear housing. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	X99
13.	<p>Connect to a known-good wireless network and retest data throughput, checking for adequate transfer speeds.</p> <p>Verify that wireless connection is sustained for several minutes.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.	\$(nodeText.yesSymptom
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99

Backlight Issue / No Backlight

Unlikely causes:

Wireless antenna(s), battery, camera, camera/microphone/ALS cable, fan, left speaker, memory, power supply, rear enclosure, right speaker, flash storage card, stand

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Display not illuminatedFlickering, unstable, or non-uniform backlightPoor backlight at some or all settingsDisplay backlight fails after warmupDisplay backlight fails at certain brightness settingsUnit appears to turn on and operate, but no image is seen on the display <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">Refer to HT201260: How to find the macOS version number on your Mac to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.Cover ambient light sensor to mimic a dark room and adjust brightness to maximum setting using F2 key on wired keyboard.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset SMC using the procedure listed for this computer in HT201295: How to reset the System Management Controller (SMC) on your Mac to return computer to a known power-off state. Try to turn on from power-off state. Do not hold in the power button when turning on the computer. You could inadvertently put the computer into DFU mode if you do.Put the computer to sleep by pressing Control-Shift-Eject. Wake it by pressing any key. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">TP1620: iMac Pro (2017): Power Supply Cover InstructionsTP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Connect a compatible external display. Check to see whether the external display mirrors the backlight issue or shows any video at all.	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
	Does external display show a video signal of any kind?	No	Go to “Power But Blank/No Video” troubleshooting flow.	\$(nodeText.noSymptomCode)	
2.	Run AST 2 MRI. Review MRI results or System Information > Graphics/Displays. Look for information indicating internal display presence in results.	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
	Does MRI detect the display?	No	Go to “Power But Blank/No Video” troubleshooting flow.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
3.	Shine bright (low-heat) flashlight onto front of display panel. With computer turned on, verify whether a faint image is visible. Does display show a video signal despite not being backlit?	Yes	Go to step 4.	\$(nodeText.yesSymptomCode)	
		No	Go to “Power But Blank/No Video” troubleshooting flow.	\$(nodeText.noSymptomCode)	
4.	Important: Ensure that user’s computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components. Inspect display power cable and its connectors between logic board and display panel. Is the cable damaged?	Yes	Replace the display panel, which includes the display power cable. Verify issue resolved.	L09	LCD
		No	Go to step 5.	\$(nodeText.noSymptomCode)	
5.	Reseat display power cable between logic board and display panel. Connect power cord to computer, wait five seconds for SMC to become ready, then press power button to start up computer. Warning: Be extremely careful when working inside the computer when power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in. For additional safety information and tips, refer to article: <ul style="list-style-type: none">TP1637: iMac Pro (2017): Safety Is normal video including backlight restored?	Yes	Issue resolved by reseating display power cable. Verify issue resolution.	\$(nodeText.yesSymptomCode)	
		No	Go to step 6.	\$(nodeText.noSymptomCode)	
6.	Important: Ensure that user’s computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components. Inspect DisplayPort cable for misrouting. Disconnect DisplayPort cable from logic board. Inspect cable for pinching and cable connector for damaged or bent pins. Is DisplayPort cable or its connector damaged?	Yes	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	Go to step 7.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
7.	Keep DisplayPort cable disconnected from logic board. Inspect DisplayPort connector on the logic board for damaged or bent pins.	Yes	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M24	MLB
	Is logic board cable connector damaged?	No	Go to step 8.	\$(nodeText.noSymptomCode)	
8.	Test the logic board backlight fuse with a multimeter. For information about using a multimeter, see article HT3250: Diagnostics: Using a digital multimeter . Refer to the service guide Functional Overview for information about locating backlight fuse.	Yes	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M25	MLB
	Locate backlight fuse on the logic board. Be careful not to scratch or knock nearby components off the logic board when using the multimeter probes. Set the multimeter to measure ohms (Ω). Place the multimeter probes on each side of the fuse that is soldered to the logic board. The multimeter should measure between zero and one ohm. Does the multimeter show a reading greater than 1 Ω ?	No	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	Reseat the DisplayPort cable between display panel and logic board. Warning: Be extremely careful when working inside the computer when power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.	Yes	Issue resolved by reseating DisplayPort cable. Verify issue resolution.	\$(nodeText.yesSymptomCode)	
	Is normal video restored?	No	Go to step 10.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
10.	<p>To troubleshoot this issue completely, a known-good DisplayPort cable is required. The iMac Display Extension Cable Kit contains an embedded DisplayPort (eDP) substitution cable that can be used for testing.</p> <p>Refer to article TP981: iMac (27-inch): Testing the Panel Using the Display Extension Cable Kit for information about how to use extension cables.</p> <p>Do you have immediate access to a known-good DisplayPort cable?</p>	Yes	Go to step 11.	\$(nodeText.yesSymptomCode}	
		No	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
11.	<p>Important: Ensure that user's computer is shut down, then remove the power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good DisplayPort cable or use the DisplayPort substitution cable found in the extension cable kit in place of suspect DisplayPort cable.</p> <p>Is normal video restored?</p>	Yes	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	Go to step 12.	\$(nodeText.noSymptomCode}	
12.	<p>To troubleshoot this issue completely, a known-good display panel is required.</p> <p>Do you have immediate access to a known-good display panel?</p>	Yes	Go to step 13.	\$(nodeText.yesSymptomCode}	
		No	Replace display panel. Verify issue resolved.	L09	LCD
13.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good display panel.</p> <p>Is normal video restored?</p>	Yes	Replace display panel. Verify issue resolved.	L09	LCD
		No	Go to step 14.	\$(nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
14.	<p>To troubleshoot this issue completely, a known-good logic board is required.</p> <p>Do you have immediate access to a known-good logic board?</p>	Yes	Go to step 15.	\$(nodeText.yesSymptomCode)	
		No	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M25	MLB
15.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good logic board.</p> <p>Is normal video restored?</p>	Yes	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M25	MLB
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	
16.	<p>Restart the computer and verify that the display backlight is fully functional.</p> <p>Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	\$(nodeText.noSymptomCode)	

Display Anomalies

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, fan, flash storage card/solid-state drive (SSD), hard disk drive (HDD), hard drive data or power or combo cable, left speaker, power supply, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antenna(s), wireless card.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"> • Distorted or blurred image • Pixel anomalies • Vertical/horizontal lines • Unstable flickering • Incorrect or missing colors • Nonuniform brightness at specific location • Vertical lines of nonuniform brightness repeating over the display • Image persistence or image sticking on screen • Light leakage around the display <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>References to the “Test Patterns Tool (TPT)” diagnostic in this procedure are intended for all iMacs introduced before 2014, that are supported by AST 1. For iMacs introduced in 2014 and later, use the “Display Anomalies” diagnostic that is supported by AST 2.</p> <p>Note: Verify the issue after using the computer for a few minutes to warm it, or by following steps in HT207571: Warm a Mac for testing. Doing this may help identify intermittent issues.</p> <ol style="list-style-type: none"> 1. Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See article HT201314: About macOS Recovery. 2. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure the system build is correct for this computer model. Check for and apply the latest software and firmware updates, especially those that deal with display or graphic issues. Remember that some external Apple display adapters also contain firmware that may need updating. For more information, refer to the following articles: <ul style="list-style-type: none"> • HT201177: Get help with video issues on external displays connected to your Mac • HT201261: Intel-based iMac: Available updates 3. Verify that System Preferences > Accessibility > Display > Display Contrast is set to Normal. 4. Check System Preferences > Displays > Color for possible use of a custom display profile. Ensure profile is set to “iMac.” 5. Check the brightness setting. 6. Clean the display and check for dust or debris. 7. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac. 8. Reset the SMC using the procedure for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP833: iMac and Displays: Power Supply Cover Instructions • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none"> • TP1620: iMac Pro (2017): Power Supply Cover Instructions • TP1637: iMac Pro (2017): Safety

	Check	Result	Action	Code	Commodity
1.	Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display.	Yes	Go to "Unstable Flickering" troubleshooting flow.	\$(nodeText.yesSymptomCode)	
	Of the eight issues below, determine if "unstable flickering" best describes the primary symptom: <ul style="list-style-type: none"> • Unstable flickering • Distorted/blurred image • Vertical/horizontal lines • Pixel anomalies • Nonuniform brightness • Incorrect or missing colors • Light leakage around the display • Image persistence or image sticking on screen 	No	Go to step 2.	\$(nodeText.noSymptomCode)	
	Is unstable flickering the primary display issue?				
2.	Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display.	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
	Of the seven issues below, determine if "distorted/blurred image" or "unstable flickering" best describes the primary symptom: <ul style="list-style-type: none"> • Distorted/blurred image • Vertical/horizontal lines • Pixel anomalies • Nonuniform brightness • Incorrect or missing colors • Light leakage around the display • Image persistence or image sticking on screen 	No	Go to step 15.	\$(nodeText.noSymptomCode)	
	Is a distorted or blurred image the primary display issue?				
3.	Connect a compatible external display.	Yes	Go to step 4.	\$(nodeText.yesSymptomCode)	
	Does image on external display appear distorted and/or blurred?	No	Go to step 9.	\$(nodeText.noSymptomCode)	
4.	A distorted or blurred image may be related to a failing memory module. Watch closely during startup sequence for exact point at which issue starts to occur.	Before	Go to step 9.	\$(nodeText.yesSymptomCode)	
	Does issue occur BEFORE or AFTER Apple logo and spinning gear appears?	After	Go to step 5.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
5.	Start the computer in Safe Mode.	Yes	Go to step 9.	`\${nodeText.yesSymptomCode}`	
	To start up into Safe Mode, follow steps listed in HT201262: Use safe mode to isolate issues with your Mac .	No	Go to step 6.	`\${nodeText.noSymptomCode}`	
	Does issue still occur in Safe Mode?				
6.	Some models have RAM modules that are directly connected to the MLB. You are unable to remove the RAM on these models.	Yes	Go to step 7.	`\${nodeText.yesSymptomCode}`	
	Are you able to remove RAM modules?	No	Go to step 9.	`\${nodeText.noSymptomCode}`	
7.	Perform one-by-one replacement of user's memory modules with known-good memory, reassemble and retest. Depending on computer model, this may simply require removal of the rear door, or the removal of display panel and logic board to access the memory modules.	Yes	Replace memory module(s). Note: Only replace defective memory module(s). There is no need to replace memory in pairs. Verify issue resolved.	X06	MEMORY
	Note: Be sure to always have at least the minimum amount of memory installed to support the computer and its OS. This may mean replacing a memory module with a known-good one of larger capacity for testing. For example, you may need to replace a 1 GB module with a known-good 2 GB module to support starting into macOS.	No	Go to step 8	`\${nodeText.noSymptomCode}`	
	Does issue occur only with specific memory module(s)?				
8.	Install a known-good memory module in one memory slot and retest. Repeat test with known-good memory for each additional memory slot, one at a time.	Yes	Replace logic board. Reinstall user's memory. Verify issue resolved.	M04	MLB
	Does issue occur only with a specific memory slot on logic board?	No	Go to step 9.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
9.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Remove display panel and inspect DisplayPort cable for misrouting. Disconnect DisplayPort cable from logic board. Inspect cable for pinching and cable connector for damaged or bent pins.</p> <p>Is DisplayPort cable or its connector damaged?</p>	Yes	Go to step 10.	\$(nodeText.yesSymptomCode}	
		No	Go to step 12.	\$(nodeText.noSymptomCode}	
10.	<p>To troubleshoot this issue completely, a known-good DisplayPort cable is required. The iMac Display Extension Cable Kit contains an embedded DisplayPort (eDP) substitution cable that can be used for testing.</p> <p>Refer to article TP981: iMac (27-inch): Testing the Panel Using the Display Extension Cable Kit or TP982: iMac (21.5-inch): Testing the Panel Using the Display Extension Cable Kit for information about how to use extension cables.</p> <p>Do you have immediate access to a known-good DisplayPort cable?</p>	Yes	Go to step 11.	\$(nodeText.yesSymptomCode}	
		No	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
11.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good eDP cable or use the eDP substitution cable found in the extension cable kit in place of suspect eDP cable.</p> <p>Is normal video restored?</p>	Yes	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	Go to step 12.	\$(nodeText.noSymptomCode}	
12.	<p>Keep DisplayPort cable disconnected from logic board. Inspect DisplayPort connector on logic board for damaged or bent pins.</p> <p>Is logic board cable connector damaged?</p>	Yes	Replace logic board. Verify issue resolved.	M24	MLB
		No	Go to step 13.	\$(nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
13.	To completely troubleshoot this issue, a known-good display panel is required. Do you have immediate access to a known-good display panel?	Yes	Go to step 14.	`\${nodeText.yesSymptomCode}`	
		No	Replace display panel. Verify issue resolved.	L04	LCD
14.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good display panel to test logic board video output.</p> <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety • TP1637: iMac Pro (2017): Safety <p>Is normal video restored?</p>	Yes	Replace display panel. Verify issue resolved.	L04	LCD
		No	Replace logic board. Reinstall user's display panel. Verify issue resolved.	M04	MLB
15.	<p>Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display.</p> <p>Of the six issues below, determine if "vertical/horizontal lines" best describes the primary symptom:</p> <ul style="list-style-type: none"> • Vertical/horizontal lines • Pixel anomalies • Nonuniform brightness • Incorrect or missing colors • Light leakage around the display • Image persistence or image sticking on screen <p>Are vertical or horizontal lines the primary display issue?</p>	Yes	Go to step 16.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 29.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
16.	Connect an external compatible display.	Yes	Go to step 17.	`\${nodeText.yesSymptomCode}`	
	Are vertical and/or horizontal lines present on external display?	No	Go to step 22.	`\${nodeText.noSymptomCode}`	
17.	Vertical and/or horizontal lines may be related to a failing memory module. Watch closely during startup sequence for exact point at which issue starts to occur.	Before	Go to step 22.	`\${nodeText.yesSymptomCode}`	
	Does issue occur BEFORE or AFTER Apple logo and spinning gear appears?	After	Go to step 18.	`\${nodeText.noSymptomCode}`	
18.	Start the computer in Safe Mode.	Yes	Go to step 22.	`\${nodeText.yesSymptomCode}`	
	To start up into Safe Mode, follow steps listed in HT201262: Use safe mode to isolate issues with your Mac . Does issue still occur in Safe Mode?	No	Go to step 19.	`\${nodeText.noSymptomCode}`	
19.	Some models have RAM modules that are directly connected to the MLB. You are unable to remove the RAM on these models.	Yes	Go to step 20.	`\${nodeText.yesSymptomCode}`	
	Are you able to remove RAM modules?	No	Go to step 22.	`\${nodeText.noSymptomCode}`	
20.	Perform one-by-one replacement of user's memory modules with known-good memory, reassemble and retest. Depending on computer model, this may simply require removal of the rear door, or the removal of display panel and logic board to access the memory modules. Note: Be sure to always have at least the minimum amount of memory installed to support computer and its OS. This may mean replacing a memory module with a known-good one of larger capacity for testing. For example, you may need to replace a 1GB module with a known-good 2GB module to support starting into macOS.	Yes	Replace memory module(s). Note: Only replace defective memory module(s). There is no need to replace memory in pairs. Verify issue resolved.	X06	MEMORY
	Does issue occur only with specific memory module(s)?	No	Go to step 21.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
21.	Install a known-good memory module in one memory slot and retest. Repeat test with known-good memory for each additional memory slot, one at a time.	Yes	Replace logic board. Reinstall user's memory. Verify issue resolved.	M04	MLB
	Does issue occur only with a specific memory slot on the logic board?	No	Go to step 22.	\$(nodeText.noSymptomCode)	
22.	Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.	Yes	Go to step 23.	\$(nodeText.yesSymptomCode)	
	Remove display panel and inspect DisplayPort cable for misrouting. Disconnect DisplayPort cable from logic board. Inspect cable for pinching and cable connector for damaged or bent pins. Is DisplayPort cable or its connector damaged?	No	Go to step 25.	\$(nodeText.noSymptomCode)	
23.	To troubleshoot this issue completely, a known-good DisplayPort cable is required. The iMac Display Extension Cable Kit contains an embedded DisplayPort (eDP) substitution cable that can be used for testing.	Yes	Go to step 24.	\$(nodeText.yesSymptomCode)	
	Refer to article TP981: iMac (27-inch): Testing the Panel Using the Display Extension Cable Kit or TP982: iMac (21.5-inch): Testing the Panel Using the Display Extension Cable Kit for information about how to use extension cables. Do you have immediate access to a known-good DisplayPort cable?	No	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
24.	Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.	Yes	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
	Substitute a known-good eDP cable or use the eDP substitution cable found in the extension cable kit in place of suspect eDP cable. Is normal video restored?	No	Go to step 25.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
25.	Keep DisplayPort cable disconnected from logic board. Inspect DisplayPort connector on logic board for damaged or bent pins.	Yes	Replace logic board. Verify issue resolved.	M24	MLB
	Is logic board cable connector damaged?	No	Go to step 26.	\$(nodeText.noSymptomCode}	
26.	To troubleshoot this issue completely, a known-good display panel is required.	Yes	Go to step 27.	\$(nodeText.yesSymptomCode}	
	Do you have immediate access to a known-good display panel?	No	Go to step 28.	\$(nodeText.noSymptomCode}	
27.	Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.	Yes	Go to step 28.	\$(nodeText.yesSymptomCode}	
	Substitute a known-good display panel to test logic board video output. Warning: Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. For additional safety information and tips, refer to articles: <ul style="list-style-type: none"> • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety • TP1637: iMac Pro (2017): Safety 	No	Replace logic board. Reinstall user's display panel. Verify issue resolved.	M04	MLB
	Is normal video restored?				
28.	Examine image on display and determine whether lines are vertical or horizontal.	Vertical	Replace display panel. Verify issue resolved.	L27	LCD
	Are lines vertical or horizontal?	Horizontal	Replace display panel. Verify issue resolved.	L26	LCD

	Check	Result	Action	Code	Commodity
29.	<p>Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display.</p> <p>Of the five issues below, determine if "pixel anomalies" best describes the primary symptom:</p> <ul style="list-style-type: none"> • Pixel anomalies • Nonuniform brightness • Incorrect or missing colors • Light leakage around the display • Image persistence or image sticking on screen <p>Are vertical or horizontal lines the primary display issue?</p>	Yes	Go to step 30.	\${nodeText.yesSymptomCode}	
		No	Go to step 32.	\${nodeText.noSymptomCode}	
30.	<p>Inspect display closely and determine whether pixel "anomalies" are actually dust or debris on surface of display panel.</p> <p>Are anomalies caused by dust, debris, or other surface contamination?</p>	Yes	Clean display panel if possible. Verify issue resolved.	\${nodeText.yesSymptomCode}	
		No	Go to step 31.	\${nodeText.noSymptomCode}	
31.	<p>Refer to article HT202025: About LCD display pixel anomalies for Apple products released in 2010 and later to determine whether number of anomalies exceeds specification. Determine whether number of bright or dark pixel anomalies (or a combination of these) exceed specification.</p> <p>Does the number of pixel anomalies exceed the specified limit?</p>	Yes	Replace display panel. Verify issue resolved.	L20	LCD
		No	Explain to user that display is within specifications. Do not replace display panel. Verify resolution.	\${nodeText.noSymptomCode}	
32.	<p>Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display.</p> <p>Of the four issues below, determine if "nonuniform brightness" best describes the primary symptom:</p> <ul style="list-style-type: none"> • Nonuniform brightness • Incorrect or missing colors • Light leakage around the display • Image persistence or image sticking on screen <p>Is nonuniform brightness the primary display issue?</p>	Yes	Go to step 33.	\${nodeText.yesSymptomCode}	
		No	Go to step 37.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
33.	<p>Determine whether variation in uniformity appears excessive when compared to a known-good similar computer.</p> <p>Does nonuniform brightness exceed that of a known-good computer?</p>	Yes	Go to step 34.	\$(nodeText.yesSymptomCode)	
		No	Display panel seems to be within specifications. Do not replace display panel. Verify resolution.	\$(nodeText.noSymptomCode)	
34.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Remove display panel. Inspect for mechanical interference from screws or cables making contact with back of display panel. Reseat components and cables.</p> <p>Carefully clean all surfaces of any leftover tape or adhesive residue where panel contacts enclosure edges to ensure a good seal and a flat mating surface when display is resealed to these surfaces.</p> <p>Is normal video restored?</p>	Yes	Issue resolved by reseating internal components. Verify issue resolution.	\$(nodeText.yesSymptomCode)	
		No	Go to step 35.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
35.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Inspect and reseal backlight cable.</p> <p>Connect power cord to computer, wait five seconds for SMC to become ready, then press power button to start up computer.</p> <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety • TP1637: iMac Pro (2017): Safety <p>Is normal video restored?</p>	Yes	Issue resolved by reseating backlight cables. Verify issue resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 36.	`\${nodeText.noSymptomCode}`	
36.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Reseat DisplayPort cable connector securely to logic board. Reconnect all internal cables and reinstall display panel. Retest.</p> <p>Is normal video restored?</p>	Yes	Issue resolved by reseating DisplayPort cable. Verify issue resolution.	`\${nodeText.yesSymptomCode}`	
		No	Replace display panel. Verify issue resolved.	L21	LCD

	Check	Result	Action	Code	Commodity
37.	<p>Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display.</p> <p>Of the three issues below, determine if "incorrect or missing colors" best describes the primary symptom:</p> <ul style="list-style-type: none"> • Incorrect or missing colors • Light leakage around the display • Image persistence or image sticking on screen <p>Is incorrect or missing colors the primary display issue?</p>	Yes	Go to step 38.	\$(nodeText.yesSymptomCode)	
		No	Go to step 46.	\$(nodeText.noSymptomCode)	
38.	<p>Verify that display is listed in System Information > Hardware > Graphics/Displays > Video Card. This ensures that color profile can be matched with display panel.</p> <p>Is display hardware detected?</p>	Yes	Go to step 39.	\$(nodeText.yesSymptomCode)	
		No	Go to step 40.	\$(nodeText.noSymptomCode)	
39.	<p>Go to System Preferences > Displays > Color to make sure "iMac" is selected under Display profile. Inspect display again for incorrect or missing colors.</p> <p>Are colors still incorrect or missing when display profile is set to "iMac"?</p>	Yes	Go to step 40.	\$(nodeText.yesSymptomCode)	
		No	Issue resolved by setting a valid display profile. User may have created an off-color calibration setting. Verify resolution.	\$(nodeText.noSymptomCode)	
40.	<p>Run Mac Resource Inspector (MRI) to check for display panel presence.</p> <p>Is display panel detected (green) in MRI?</p>	Yes	Go to step 42.	\$(nodeText.yesSymptomCode)	
		No	Go to step 41.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
41.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Reseat DisplayPort cable connector securely to logic board and retest.</p> <p>Connect power cord to computer, wait five seconds for SMC to become ready, then press power button to start up computer.</p> <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips refer to articles:</p> <ul style="list-style-type: none"> • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety • TP1637: iMac Pro (2017): Safety <p>Is normal video restored?</p>	Yes	Issue resolved by reseating DisplayPort cable. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 42.	`\${nodeText.noSymptomCode}`	
42.	<p>Launch the Test Pattern Tool (TPT) in AST or the Display Anomalies test suite in AST 2 to display the Solid Gray Light display test pattern.</p> <p>Verify whether incorrect/missing color issue affects entire screen.</p> <p>Is entire screen affected?</p>	Yes	Go to step 44.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 43.	`\${nodeText.noSymptomCode}`	
43.	<p>Put computer side-by-side with a known-good equivalent iMac display showing same Solid Gray Light image.</p> <p>Is issue noticeably worse on the user's display?</p>	Yes	Go to step 44.	`\${nodeText.yesSymptomCode}`	
		No	Small variations in color uniformity are normal and do not warrant replacement of display.	`\${nodeText.noSymptomCode}`	
44.	<p>To troubleshoot this issue completely, a known-good display panel is required.</p> <p>Do you have immediate access to a known-good display panel?</p>	Yes	Go to step 45.	`\${nodeText.yesSymptomCode}`	
		No	Replace display panel. Verify issue resolved.	L02	LCD

	Check	Result	Action	Code	Commodity
45.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good display panel to test logic board video output.</p> <p>Is normal video restored?</p>	Yes	Replace display panel. Verify issue resolved.	L02	LCD
		No	Replace logic board. Reinstall user's display panel. Verify issue resolved.	M04	MLB
46.	<p>Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display.</p> <p>Of the two issues below, determine if "light leakage around the display" best describes the primary symptom:</p> <ul style="list-style-type: none"> • Light leakage around the display • Image persistence or image sticking on screen <p>Is light leakage around display edges the primary display issue?</p>	Yes	Go to step 47.	\${nodeText.yesSymptomCode}	
		No	Go to step 50.	\${nodeText.noSymptomCode}	
47.	<p>Launch the Test Pattern Tool (TPT) in AST or the Display Anomalies test suite in AST 2 to display the All Black display test pattern.</p> <p>It is very important that you verify this issue using ONLY an all black display test pattern with no other images present such as icons, dock, and so on.</p> <p>Adjust display position and brightness to normal settings.</p> <p>Dim lights so you can more clearly see any light leakage around edges of the display panel.</p> <p>Is any noticeable light leakage present around edges of the display?</p>	Yes	Go to step 48.	\${nodeText.yesSymptomCode}	
		No	Explain to user that display is within specifications. Do not replace display panel. Verify resolution.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
48.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Carefully disconnect and remove display panel.</p> <p>Carefully clean all surfaces of any leftover tape or adhesive residue where panel contacts enclosure edges to ensure a good seal and a flat mating surface when display is reseated to these surfaces.</p>	Yes	Replace chin strap. Reinstall user's display panel. Verify issue resolved.	X13	PIECE PART
	<p>Remove and closely inspect chin strap for any damage, bowing, or bending.</p> <p>Verify that all cushioned pads are securely installed on each end of the chin strap and are not damaged, torn, out of place, or missing. These pads are part of the chin strap.</p> <p>Does chin strap appear damaged, bent, or bowed?</p>	No	Go to step 49.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
49.	Recheck that previous disassembly was performed properly using proper tools and techniques and not by simply pulling display off. Incorrect removal technique can damage or bow chin strap, causing light leakage in lower display area.	Yes	Replace display panel. Verify issue resolved.	L28	LCD
	<p>Reinstall chin strap, being very careful to not damage, bow, or otherwise bend chin strap during installation.</p> <p>Reapply new foam tape gaskets for all four display sides, being very careful to apply the tape smoothly around entire edge.</p> <p>Reinstall display panel, being careful when seating edges of display against foam-backed tape around edges to ensure a smooth, complete seal around entire perimeter.</p> <p>Connect power cord to computer, wait five seconds for SMC to become ready, then press power button to start up computer.</p> <p>Retest using the Test Pattern Tool (TPT) in AST or the Display Anomalies test suite in AST 2 to display the All Black display test pattern.</p> <p>Is any noticeable light leakage still present around edges of display?</p>	No	Issue resolved by reseating display and chin strap. Verify issue resolution.	\$(nodeText.noSymptomCode)	
50.	A display might show a temporary faint remnant of a previous image even after a new image replaces it. Follow instructions using procedure listed for this computer in article TP949: Image Persistence Test to determine if display fails or passes the Image Persistence Test.	Yes	Replace display panel. Verify issue resolved.	L25	LCD
	Does the display fail the Image Persistence Test?	No	The display is within specification. Do not replace display panel.	\$(nodeText.noSymptomCode)	
51.	Verify that display issue or anomaly has been resolved.	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
	<p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is issue resolved?</p>	No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

Power But Blank/No Video

Unlikely causes:

Battery, camera/microphone/ALS cable, CPU fan, flash storage card, left speaker, power supply, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antenna(s)

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Power available, but no video visible on display• Fan spinning sounds are audible• Caps Lock key LED illuminates when pressed <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options</p>	<ol style="list-style-type: none">1. Adjust settings to increase screen brightness.2. In the event that there is an iBridge / macOS version mismatch in the user's computer, iBridge firmware will update automatically while the computer is connected to the Internet. During this process the computer's display can remain completely black for some period of time (at least 30 seconds). If the computer is turned off or disconnected from the Internet during this process under the assumption that something went wrong, the black screen will occur again until the iBridge update has completed. To resolve this issue, plug in the computer, attempt to turn it on, then wait at least one minute to provide an opportunity for any updates to complete if needed. Once completed, the computer should display video once again. For more information, see OP1935: iMac Pro (2017) Service Readiness Guide.3. After logic board replacement, if the computer turns on but displays only a black screen and does not start up, this could mean that the replacement logic board has not yet been configured for use. For complete instructions to configure a replacement logic board, refer to TP1625: How to use the Mac Configuration Utility.4. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.5. Reset SMC using the procedure listed for this computer in HT201295: How to reset the System Management Controller (SMC) on your Mac to return computer to a known power-off state. Try to turn on from power-off state. Do not hold in the power button when turning on the computer. You could inadvertently put the computer into DFU mode if you do.6. Disconnect all peripherals.7. Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See article HT201314: About macOS Recovery.8. Refer to HT201260: How to find the macOS version number on your Mac to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP1620: iMac Pro (2017): Power Supply Cover Instructions• TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac .	Yes	Go to step 3.	`\${nodeText.yesSymptomCode}`	
	Press the power button to start up the computer.				
	Look and listen for any evidence that the computer is starting up. Be aware that this iMac model does not emit a startup sound.	No	Go to step 2.	`\${nodeText.noSymptomCode}`	
	Is there any evidence that the computer is starting up?				
2.	Connect a known-good Apple wired keyboard and Apple wired mouse to user's computer.	Yes	Go to “Will Not Start Up” troubleshooting flow.	`\${nodeText.yesSymptomCode}`	
	Hold down Command-R during startup to restart from the recovery partition.				
	Check whether computer has a memory error (a series of beep tones during startup).	No	Go to step 3.	`\${nodeText.noSymptomCode}`	
	Does computer make error tones during startup?				
3.	Determine whether issue is no backlight or no image:				
	<ul style="list-style-type: none"> Image with no backlight can be seen by shining a flashlight onto the built-in display during or after startup. No image can be identified by a blank display with or without backlight or a solid color on the built-in display. 	No Backlight	Go to “Backlight Issue / No Backlight” troubleshooting flow.	`\${nodeText.yesSymptomCode}`	
		No Image	Go to step 4.	`\${nodeText.noSymptomCode}`	
	Is the issue no backlight or no image?				
4.	Connect a known-good external display and press power button. Hold down Command-R during startup to restart from the recovery partition. Toggle video mirroring (Command-F1) to view main screen startup screen on external display. Verify that video is correct when viewed on external display.	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 11.	`\${nodeText.noSymptomCode}`	
	Is correct image visible on external display?				

	Check	Result	Action	Code	Commodity
5.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding and allow the power supply and logic board to discharge.	Yes	Go to step 11.	\$(nodeText.yesSymptomCode)	
	<p>Use one of the methods below to determine whether the user's computer recognizes its built-in display panel.</p> <p>METHOD 1: Review MRI results or System Information > Graphics/Displays. Look for information indicating internal display presence in results.</p> <p>METHOD 2: Follow service guide procedures to remove the display to gain access to view diagnostic LEDs on the logic board. Use display extension cables and the display service stand to keep the display connected while removed.</p>	No	Go to step 6.	\$(nodeText.noSymptomCode)	
6.	<p>Connect AC power cord to the computer and plug into mains. Locate diagnostic LEDs on logic board. Press the power button to start up the computer. Press the diagnostic button (near diagnostic LEDs on logic board) to activate and view LEDs. During startup, the computer should communicate with video controller and light diagnostic LED #5 to indicate an active display.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>Is built-in display panel detected?</p>	Yes	Go to step 7.	\$(nodeText.yesSymptomCode)	
	<p>Inspect eDP cable and connectors for damage. Also inspect connectors on display panel and logic board.</p> <p>Did you find any damaged components?</p>	No	Go to step 8.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
7.	<p>Damage to multiple parts requires an escalation to ACS for approval for repair.</p> <p>Is damage limited to eDP cable only?</p>	Yes	Replace embedded DisplayPort (eDP) cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	<p>\$(nodeText.noSymptomCode)</p>	
8.	<p>Test the logic board display power fuse with a multimeter. For information about using a multimeter, see article HT3250: Diagnostics: Using a digital multimeter.</p> <p>Refer to the service guide Functional Overview for information about locating display fuse.</p> <p>Locate display fuse on the logic board. Be careful not to scratch or knock nearby components off the logic board when using the multimeter probes.</p> <p>Set the multimeter to measure ohms (Ω). Place the multimeter probes on each side of the fuse that is soldered to the logic board. The multimeter should measure between zero and one ohm.</p> <p>Does the multimeter show a reading greater than 1 Ω?</p>	Yes	Replace logic board. Verify issue resolved.	M03	MLB
		No	Go to step 9.	<p>\$(nodeText.noSymptomCode)</p>	
9.	<p>To troubleshoot this issue completely, a known-good eDP cable is required. The iMac Display Extension Cable Kit contains an eDP substitution cable that can be used for testing.</p> <p>Refer to article TP981: iMac (27-inch): Testing the Panel Using the Display Extension Cable Kit for information about how to use extension cables.</p> <p>Do you have immediate access to a known-good eDP cable?</p>	Yes	Go to step 10.	<p>\$(nodeText.yesSymptomCode)</p>	
		No	Replace embedded DisplayPort (eDP) cable. Verify issue resolved.	X03	INTERNAL CABLE

	Check	Result	Action	Code	Commodity
10.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good eDP cable or use the eDP substitution cable found in the extension cable kit in place of suspect eDP cable.</p> <p>If any known-good cables are still installed from previous steps, continue using known-good cables to help find faulty module.</p> <p>Does display present video with or without backlight?</p>	With Backlight	Replace embedded DisplayPort (eDP) cable. Verify issue resolved.	X03	INTERNAL CABLE
		No Backlight	Replace the display panel. Verify issue resolved.	L03	LCD
11.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding and allow the power supply and logic board to discharge.</p> <p>Remove display panel.</p> <p>Locate diagnostic LEDs on logic board. Connect AC power cord and press power button. Press the diagnostic button (near diagnostic LEDs on logic board) to activate and view LEDs. Diagnostic LEDs #1 and #2 should turn on. This indicates power to computer.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>Are diagnostic LEDs #1 and #2 on?</p>	Yes	Go to step 12.	\${nodeText.yesSymptomCode}	
		No	Go to "No Power" troubleshooting flow.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
12.	Disconnect embedded DisplayPort (eDP) cable from logic board. Connect a known-good external display and press power button. Hold down Command-R during startup to restart from recovery partition. Toggle video mirroring (Command-F1) to view main screen startup screen on external display. Verify that video is correct when viewed on external display. Is correct image visible on external display?	Yes	Replace display panel. Verify issue resolved.	L03	LCD
		No	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M03	MLB
13.	Restart the computer and verify that the video is fully functional. Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	\${nodeText.noSymptomCode}	

Unstable Flickering

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, fan, hard disk drive (HDD), hard drive data or power or combo cable, left speaker, memory, power supply, rear enclosure, right speaker, solid-state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antennas, wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Flickering video image• Flickering backlight• Dock and/or menu bar position not stable• Display intermittently flashes on/off• Unstable image <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>Note: Verify the issue after using the computer for a few minutes to warm it, or by following steps in HT207571: Warm a Mac for testing. Doing this may help identify intermittent issues.</p> <ol style="list-style-type: none">1. Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See article HT201314: About macOS Recovery.2. Check the brightness setting.3. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure the system build is correct for this computer model. Check for and apply the latest software and firmware updates, especially those that deal with display or graphic issues. Remember that some external Apple display adapters also contain firmware that may need updating. For more information, refer to the following articles:<ul style="list-style-type: none">• HT201177: Get help with video issues on external displays connected to your Mac• HT201261: Intel-based iMac: Available updates4. Clean display and check for dust or debris.5. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.6. Reset the SMC using the procedure listed for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none">• TP1620: iMac Pro (2017): Power Supply Cover Instructions• TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Adjust built-in display brightness setting to low backlight level, just above off.	Backlight	Go to step 2.	`\${nodeText.yesSymptomCode}`	
	<p>Verify whether user issue is due to backlight flickering or to an unstable or flickering video image on display.</p> <p>You may need to shine a bright (low heat) flashlight onto front of display panel with computer turned ON to verify whether a faint video image is occasionally visible through the flickering.</p> <p>Note: If video is present but backlight never turns on, exit this procedure and go to the “Backlight Issue / No Backlight” troubleshooting flow instead. Use this procedure only for flickering backlight or video image.</p> <p>Which is flickering, backlight or video?</p>	Video	Go to step 8.	`\${nodeText.noSymptomCode}`	
2.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Inspect display power cable and its connectors between logic board and display panel.</p> <p>Is display power cable damaged?</p>	Yes	Replace display panel, which includes display power cable. Verify issue resolved.	L06	LCD
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
3.	Reseat display power cable between logic board and display panel. Connect power cord to computer, wait five seconds for SMC to become ready, then press power button to start up computer.	Yes	Issue resolved by reseating display power cable. Verify issue resolution.	`\${nodeText.yesSymptomCode}`	
	<p>Warning: Be extremely careful when working inside the computer while power is connected and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety • TP1637: iMac Pro (2017): Safety <p>Is normal video restored?</p>	No	Go to step 4.	`\${nodeText.noSymptomCode}`	
4.	To troubleshoot this issue completely, a known-good display panel is required.	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
	Do you have immediate access to a known-good display panel?	No	Replace display panel. Verify issue resolved.	L06	LCD
5.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good display panel.</p> <p>Is normal video restored?</p>	Yes	Replace display panel. Verify issue resolved.	L06	LCD
		No	Go to step 6.	`\${nodeText.noSymptomCode}`	
6.	To troubleshoot this issue completely, a known-good power supply is required.	Yes	Go to step 7.	`\${nodeText.yesSymptomCode}`	
	Do you have immediate access to a known-good power supply?	No	Replace power supply. Verify issue resolved.	P99	POWER SUPPLY

	Check	Result	Action	Code	Commodity
7.	<p>Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good power supply.</p> <p>Is normal video restored?</p>	Yes	Replace power supply. Verify issue resolved.	P99	POWER SUPPLY
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	
8.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel and inspect DisplayPort cable for misrouting. Disconnect DisplayPort cable from logic board. Inspect cable for pinching and cable connector for damaged or bent pins.</p> <p>Is DisplayPort cable or its connector damaged?</p>	Yes	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	<p>Keep DisplayPort cable disconnected from logic board. Inspect DisplayPort connector on logic board for damaged or bent pins.</p> <p>Is logic board cable connector damaged?</p>	Yes	Replace logic board. Verify issue resolved.	M24	MLB
		No	Go to step 10.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
10.	Reseat DisplayPort cable between LCD panel and logic board. Connect power cord to computer, wait five seconds for SMC to become ready, then press power button to start up computer.	Yes	Issue resolved by reseating DisplayPort cable. Verify issue resolution.	\$(nodeText.yesSymptomCode)	
	Warning: Be extremely careful when working inside the computer while power is connected and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.				
	For additional safety information and tips, refer to articles: <ul style="list-style-type: none"> • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety • TP1637: iMac Pro (2017): Safety 	No	Go to step 11.	\$(nodeText.noSymptomCode)	
	Is normal video restored?				
11.	To troubleshoot this issue completely, a known-good DisplayPort cable is required. The iMac Display Extension Cable Kit contains an embedded DisplayPort (eDP) substitution cable that can be used for testing.	Yes	Go to step 12.	\$(nodeText.yesSymptomCode)	
	Refer to article TP981: iMac (27-inch): Testing the Panel Using the Display Extension Cable Kit or TP982: iMac (21.5-inch): Testing the Panel Using the Display Extension Cable Kit for information about how to use extension cables.	No	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
	Do you have immediate access to a known-good DisplayPort cable?				
12.	Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.	Yes	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
	Substitute a known-good eDP cable or use the eDP substitution cable found in the extension cable kit in place of suspect eDP cable.	No	Go to step 13.	\$(nodeText.noSymptomCode)	
	Is normal video restored?				

	Check	Result	Action	Code	Commodity
13.	To troubleshoot this issue completely, a known-good display panel is required. Do you have immediate access to a known-good display panel?	Yes	Go to step 14.	\${nodeText.yesSymptomCode}	
		No	Replace display panel. Verify issue resolved.	L06	LCD
14.	Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components. Substitute a known-good display panel. Is normal video restored?	Yes	Replace display panel. Verify issue resolved.	L06	LCD
		No	Replace logic board. Reinstall user's display panel. Verify issue resolved.	M29	MLB
15.	Confirm that the computer display flickering or unstable video issue is resolved. Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	\${nodeText.noSymptomCode}	

Audio-in Jack Issues

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, fan, DisplayPort cable, hard disk drive (HDD), hard drive data or power or combo cable, display panel, left speaker, memory, power supply, right speaker, solid-state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antennas, wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">External audio-in port does not work with an analog or digital line-level source <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">Use controls to adjust sound volume and ensure that audio output is not muted.Ask user which type of audio input cable is connected to the computer's audio-in jack: analog or optical cable. <p>Important: Some iMac models do not support optical audio. Refer to Apple product specifications for more information.</p> <ol style="list-style-type: none">Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See article HT201314: About macOS Recovery.Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.Check that a known-good audio cable is used with the analog 3.5 mm stereo mini plug end connected to the proper input on the computer and the other end connected to a compatible line-level audio source.Check that a known-good analog audio device (such as an iPod, iPhone, or Mac) is used as a source and is playing audio.On the user's computer, go to System Preferences > Sound and verify the following:<ul style="list-style-type: none">Input tab:<ul style="list-style-type: none">"Line In" input source is available and selected when an analog audio source is connected."Input volume" slider is not set to zero (available only with an analog audio input).Output tab:<ul style="list-style-type: none">Sound output device is set to Internal Speakers.Output volume is not muted or set to zero.Open QuickTime Player. Choose "New Audio Recording" from File menu. Choose "Built-in Input: Line In" input source from right pop-up menu and adjust sound volume using slider in center of window.If audio is heard, then verify user's cable and audio device using same process. <p>Note: Disconnecting an analog stereo mini plug cable from the iPod/iPhone side will pause audio playback.</p> <ol style="list-style-type: none">Perform visual and mechanical inspection of audio input and output jacks. Use an otoscope to inspect for dust and/or debris. Use compressed air to clean and remove any dust and/or debris.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p>

	<p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP833: iMac and Displays: Power Supply Cover Instructions • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none"> • TP1620: iMac Pro (2017): Power Supply Cover Instructions • TP1637: iMac Pro (2017): Safety
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Deep Dive

	Check	Result	Action	Code	Commodity
1.	Play a known-good audio file or reliable Internet radio station via iTunes. Verify that sound is clearly audible and free of distortion through both headphones and internal speakers. Does the audio file play correctly?	Yes	Go to step 3.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 2.	`\${nodeText.noSymptomCode}`	
2.	Specify whether playback from known-good audio source is distorted or not audible.	Distorted	Go to “Distorted Audio from Internal Speaker(s)” troubleshooting flow.	`\${nodeText.yesSymptomCode}`	
	Is sound distorted or not audible?	Not Audible	Go to “No Audio from Internal Speaker(s) or Headphone Jack” troubleshooting flow.	`\${nodeText.noSymptomCode}`	
3.	Hold down Command-R during startup to restart from recovery partition, and try to reproduce audio input issue using known-good audio sources and cables. Does audio issue persist with known-good OS?	Yes	Go to step 4.	`\${nodeText.yesSymptomCode}`	
		No	Reinstall macOS on the user's computer. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	`\${nodeText.noSymptomCode}`	
4.	From user information, identify whether analog line-in or optical digital-in is causing issue.	Analog Line-in	Go to step 5.	`\${nodeText.yesSymptomCode}`	
	Some iMac models do not support optical audio. Refer to Apple product specifications for more information. Which audio input is affected: analog line-in or optical digital-in?	Optical Digital-in	Go to step 10.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
5.	<p>To troubleshoot this issue completely, a known-good 3.5 mm stereo cable is required.</p> <p>Do you have immediate access to a known-good 3.5 mm stereo cable?</p>	Yes	Go to step 6.	`\${nodeText.yesSymptomCode}`	
		No	ESCALATION REQUIRED. Computer analog input cannot be tested without an adequate 3.5 mm male-to-male stereo mini plug cable.	`\${nodeText.noSymptomCode}`	
6.	<p>Disconnect any cable from audio in (mic) port to verify default setting for audio in.</p> <p>In System Preferences > Sound > Input, verify that the Line In audio input source is listed and that the Input volume slider is present.</p> <p>Set Input volume to middle position.</p> <p>Is Line In audio input available?</p>	Yes	Go to step 8.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 7.	`\${nodeText.noSymptomCode}`	
7.	<p>Line in activity appears to be stuck to optical digital-in mode:</p> <ul style="list-style-type: none"> • Insert a 3.5 mm stereo mini plug into the audio in port and then rapidly unplug it and plug it in several times to reset internal switches in the connector. • Verify whether System Preferences > Sound > Input reverts to Line In after plug insertion and removal. • Close and reopen Sound Preferences window to refresh list of current audio input sources. <p>Does audio input in System Preferences revert to Line In after minijack insertion and removal?</p>	Yes	Issue resolved by resetting audio-in jack. To prevent the issue from recurring suggest that user check physical specifications of cable connectors previously connected to this jack.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 14.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
8.	Play a known-good audio file or Internet radio station in iTunes, and verify that it plays through internal speakers.	Yes	Go to step 9.	`\${nodeText.yesSymptomCode}`	
	<p>Connect 3.5 mm male-to-male stereo mini plug cable between the audio in (mic) port and the audio out (headphone) port.</p> <p>In System Preferences > Sound > Output verify that Headphones audio output source appears and select it.</p> <p>In System Preferences > Sound > Input, select Line In, then adjust the Input volume slider to observe activity level without peaking at maximum.</p> <p>Does the bar graph at bottom of recording window show input activity?</p>	No	Go to step 14.	`\${nodeText.noSymptomCode}`	
9.	Open QuickTime Player and choose New Audio Recording from File menu.	Yes	Computer analog audio input appears to be performing to specifications. Verify issue resolved.	`\${nodeText.yesSymptomCode}`	
	<p>In the new recording window, choose "Built-In: Line Input" source from input source right pop-up menu. Adjust volume using slider in center of window.</p> <p>Press record button to start recording. Record for several seconds, then click record button again to stop recording.</p> <p>Disconnect stereo cable from audio out (headphone) port to hear audio through internal speakers. If needed, press F11-F12 keys to adjust volume, and confirm that computer is able to play sound.</p> <p>Stop playing known-good audio file or Internet radio.</p> <p>Play recorded audio file.</p> <p>Does computer accurately reproduce sound recorded from audio input?</p>	No	Go to step 14.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
10.	<p>To troubleshoot this issue completely, a known-good 3.5 mm mini-TOSLINK optical cable is required.</p> <p>Do you have immediate access to a known-good 3.5 mm mini-TOSLINK cable?</p>	Yes	Go to step 11.	`\${nodeText.yesSymptomCode}`	
		No	ESCALATION REQUIRED. Computer digital input cannot be tested without adequate 3.5 mm mini-TOSLINK male-to-male optical cable.	`\${nodeText.noSymptomCode}`	
11.	<p>Connect 3.5 mm mini-TOSLINK cable to the audio out (headphone) port.</p> <p>In System Preferences > Sound > Output, verify that a Digital Out audio output source appears, and select it.</p> <p>Play a known-good audio file or Internet radio station.</p> <p>Audio out should switch to optical digital audio, and unplugged end of cable will emit a red light to indicate transmission of a digital audio stream.</p> <p>Is red light visible at unplugged end of mini-TOSLINK cable?</p>	Yes	Go to step 12.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 14.	`\${nodeText.noSymptomCode}`	
12.	<p>Continue to play known-good audio.</p> <p>Connect other end of 3.5 mm mini-TOSLINK cable to audio in (mic) port.</p> <p>Open QuickTime Player and choose New Audio Recording from File menu.</p> <p>In the new recording window, choose "Built-in Input: Digital In" from the input source pop-up menu, and adjust volume using slider in center of window.</p> <p>Does the bar graph at bottom of the recording window show input activity?</p>	Yes	Go to step 13.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 14.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
13.	Press record button to start recording. Record for several seconds. Press record button again to stop recording.	Yes	Computer digital audio input appears to be performing to specifications. Verify issue resolved.	`\${nodeText.yesSymptomCode}`	
	<p>Disconnect optical cable from audio out (headphone) port to hear audio through internal speakers. Press F11 and F12 keys to adjust volume, and confirm that computer is able to play sound.</p> <p>Stop playing known-good audio.</p> <p>Play the recorded audio file.</p> <p>Does computer accurately reproduce sound recorded from audio input?</p>	No	Go to step 14.	`\${nodeText.noSymptomCode}`	
14.	Disconnect cable from audio in (mic). Open QuickTime Player and choose New Audio Recording from the File menu. Choose "Built-in Microphone: Internal Microphone" from the pop-up menu to record from an internal microphone input source. Compare distortion between recorded internal input and external input sources.	Yes	Replace logic board. Verify issue resolved.	M09	MLB
	<p>Is recorded sound also distorted when recorded from internal microphone input?</p>	No	Go to step 15.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
15.	Disconnect headphones or external speakers.	Yes	Issue resolved by reseating audio cable. Verify resolution.	`\${nodeText.yesSymptomCode}`	
	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Inspect audio cable connector and its corresponding connector on logic board. Reseat connection and retest.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>Is recorded sound audible, clear, and free of distortion?</p>	No	Go to step 16.	`\${nodeText.noSymptomCode}`	
16.	<p>To troubleshoot this issue completely, a known-good rear enclosure is required.</p> <p>Do you have immediate access to a known-good rear enclosure?</p>	Yes	Go to step 17.	`\${nodeText.yesSymptomCode}`	
		No	<p>ESCALATION REQUIRED.</p> <p>Audio I/O ports are part of the rear enclosure. Replace the rear enclosure. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	X99	

	Check	Result	Action	Code	Commodity
17.	<p>Substitute a known-good rear enclosure with audio ports and retest recording.</p> <p>To do this, carefully place known-good rear enclosure near the user's computer, then temporarily plug audio flex cable from known-good rear enclosure into audio connector on the logic board inside user's computer.</p> <p>Is recorded sound audible, clear, and free of distortion?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Audio I/O ports are part of the rear enclosure. Replace the rear enclosure. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	X99	
		No	Replace logic board. Verify issue resolved.	M09	MLB
18.	<p>Plug a known-good analog audio source into audio in jack, and verify that sound recorded is audible and free of distortion.</p> <p>Repeat with digital (optical) audio source (for models that support digital optical audio only).</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

Camera Issues

Unlikely causes:

Battery, fan, DisplayPort cable, left speaker, memory, power supply, rear enclosure, right speaker, flash storage card, stand, Wi-Fi/Bluetooth antenna(s)

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Camera not detected• No green LED for camera• Excessive blooming• Poor white balance• Poor focus• Green image• Image distortion <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Refer to HT201260: How to find the macOS version number on your Mac to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.2. Verify that the camera lens and display are clean and clear of contaminants.3. Verify that another application is not using the camera. Refer to HT201715: “Your camera is in use by another application” message.4. Ask user about lighting conditions in his or her working environment. Dim lighting causes poor image quality. Overly bright lighting can bounce off surfaces onto subject and make image foggy.5. Striped, textured, and mesh clothing can create moiré patterns in image.6. Reset SMC using the procedure listed for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac to return computer to a known power-off state. Try to turn on from power-off state. Do not hold in the power button when resetting the SMC. You could inadvertently put the computer into DFU mode if you do.7. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac8. Disconnect all peripheral devices and restart computer. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP1620: iMac Pro (2017): Power Supply Cover Instructions• TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Check Mac Resource Inspector (MRI) results to verify that the camera is detected.	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
	If AST 1 or AST 2 is not available, use System Information to verify that the FaceTime HD Camera is recognized.				
	The camera will be listed in System Information > Hardware > Camera Device Tree. Verify that “FaceTime HD Camera (Internal)” is listed.	No	Go to step 3.	`\${nodeText.noSymptomCode}`	
	Does MRI or System Information detect the camera?				
2.	Launch Photo Booth. Verify that the green LED next to the camera illuminates when an image is present in Photo Booth.	Yes	Go to step 4.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	
	Does the camera LED light up?				
3.	Follow steps listed in HT208198: About Boot Security Utility to enable starting up from an external storage device on the user’s computer.				
	Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT201260: How to find the macOS version number on your Mac .	Yes	Reinstall macOS on the user’s computer. Refer to HT201260: How to find the macOS version number on your Mac to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	`\${nodeText.yesSymptomCode}`	
	Retest the camera.				
	Does the camera function properly in a known-good OS?	No	Go to step 5.	`\${nodeText.noSymptomCode}`	
4.	Verify that the camera image is clear and undistorted.	Yes	The issue is resolved. Verify resolution.	`\${nodeText.yesSymptomCode}`	
	Is the image clear?	No	Go to step 5.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
5.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Locate and disconnect the camera/front microphone/ALS cable from the logic board and camera.</p> <p>Inspect both ends of the cable, the logic board connector, and the camera connector for any damage.</p> <p>Is there any damage to the camera/front microphone/ALS cable or any connectors?</p>	Yes	Go to step 6.	\${nodeText.yesSymptomCode}	
		No	Go to step 7.	\${nodeText.noSymptomCode}	
6.	<p>Determine whether the damage is located on the camera/front microphone/ALS cable, the logic board, the camera, or a combination of multiple components.</p> <p>Is the damage limited to the camera/front microphone/ALS cable only?</p>	Yes	<p>Replace the camera/front microphone/ALS cable.</p> <p>Verify that the issue is resolved.</p>	X03	INTERNAL CABLE
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
7.	<p>Reseat camera/front microphone/ALS cable securely to logic board and camera.</p> <p>Turn on computer and check System Information again.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>Does camera appear in System Information?</p>	Yes	Go to step 8.	\${nodeText.yesSymptomCode}	
		No	Go to step 9.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
8.	Launch Photo Booth. Verify that green LED next to camera lights up. Make sure image looks normal.	Yes	Issue resolved by reseating the camera/front microphone/ALS cable. Verify resolution.	`\${nodeText.yesSymptomCode}`	
	Does camera LED light up and image appear normal?	No	Go to step 11.	`\${nodeText.noSymptomCode}`	
9.	To troubleshoot this issue completely, a known-good camera/front microphone/ALS cable is required.	Yes	Go to step 10.	`\${nodeText.yesSymptomCode}`	
	Do you have immediate access to a known-good camera/front microphone/ALS cable?	No	Replace camera/front microphone/ALS cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
10.	Substitute a known-good camera/front microphone/ALS cable and retest.	Yes	Replace camera/front microphone/ALS cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
	Is camera working normally?	No	Go to step 11.	`\${nodeText.noSymptomCode}`	
11.	The camera is part of the display panel in this model.	Yes	Go to step 12.	`\${nodeText.yesSymptomCode}`	
	To troubleshoot this issue completely, a known-good display panel is required.	No	Replace display panel, which includes the camera. Verify issue resolved.	L17	LCD
12.	Substitute a known-good display panel and retest.	Yes	Replace display panel, which includes the camera. Verify issue resolved.	L17	LCD
	Is camera working normally?	No	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M13	MLB

	Check	Result	Action	Code	Commodity
13.	<p>Confirm that the computer's FaceTime camera is recognized and functional.</p> <p>Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

Distorted Audio from Internal Speaker(s)

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, fan, DisplayPort cable, flash storage card/solid-state drive (SSD), hard disk drive (HDD), hard drive data or power or combo cable, display panel, memory, power supply, stand, Wi-Fi/Bluetooth antennas, wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Sound is distorted, fuzzy, or crackly.• Symptom only appears in internal speaker.• Symptom also appears in external speakers/headphones. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Test with a known-good stereo sound file.2. Compare the same sound and settings against a known-good similar model computer to make sure sound is indeed distorting.3. In System Preferences > Sound > Output, adjust the Output volume and use Balance slider to isolate left and right speakers. Check whether issue only happens with one speaker.4. If testing with iTunes, make sure both equalizer and preamp settings are set to Flat.5. Test audio output using more than one application or website.6. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac7. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none">• TP1620: iMac Pro (2017): Power Supply Cover Instructions• TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version.</p> <p>Does the audio issue persist from a known-good OS?</p>	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Reinstall macOS on the user's computer. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	\$(nodeText.noSymptomCode)	
2.	<p>Play known-good audio file on internal speakers, then connect known-good headphones or external speakers and compare for distortion.</p> <p>Is sound also distorted through headphones or external speakers?</p>	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
		No	Go to step 7.	\$(nodeText.noSymptomCode)	
3.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Inspect audio cable to audio I/O ports and its corresponding connection on logic board.</p> <p>Did you find damage to audio cable or logic board connector?</p>	Yes	Go to step 4.	\$(nodeText.yesSymptomCode)	
		No	Go to step 5.	\$(nodeText.noSymptomCode)	
4.	<p>Determine whether damage is on the logic board, audio cable, or both.</p> <p>Is the damage limited to logic board?</p>	Yes	Replace the logic board. Verify that the issue is resolved.	M09	MLB
		No	<p>ESCALATION REQUIRED.</p> <p>Audio I/O ports are part of the rear enclosure. Replace the rear enclosure. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
5.	To troubleshoot this issue completely, a known-good logic board is required.	Yes	Go to step 6.	\${nodeText.yesSymptomCode}	
	Do you have immediate access to a known-good logic board?	No	Replace the logic board. Verify that the issue is resolved.	M09	MLB
6.	Substitute known-good logic board and retest. Is sound through headphones or external speakers audible, clear, and free of distortion?	Yes	Replace the logic board. Verify that the issue is resolved.	M09	MLB
		No	<p>ESCALATION REQUIRED.</p> <p>Audio I/O ports are part of the rear enclosure. Replace the rear enclosure. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	\${nodeText.noSymptomCode}	
7.	Run AST 1 or AST 2 Audio Test to verify left and right speakers produce expected audio test patterns from each speaker.	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
	Refer to article TP587: Using Audio Test .				
	Does unit pass Audio Test?	No	Go to step 8.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
8.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Locate speaker connections on logic board. Disconnect and inspect both speaker cable connectors and corresponding connectors on logic board for damage.</p> <p>Reconnect the left and right speakers to the logic board, verifying that the connections are all seated properly.</p> <p>Did you find damage to speakers or logic board connector?</p>	Yes	Go to step 9.	\${nodeText.yesSymptomCode}	
		No	Go to step 10.	\${nodeText.noSymptomCode}	
9.	<p>Determine whether damage is on the logic board, speakers, or both.</p> <p>Is the damage limited to speaker(s)?</p>	Yes	<p>Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit.</p> <p>Verify that the issue is resolved.</p>	X08	OTHER ELECTRIC
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

	Check	Result	Action	Code	Commodity
10.	With speaker connectors reseated to logic board, verify you can hear audio through internal speakers.	Yes	The issue was resolved by reseating cables. Verify resolution.	\$(nodeText.yesSymptomCode)	
	<p>In System Preferences > Sound > Output tab, adjust Balance slider to check left and right speaker channel separation.</p> <p>Play music with high and low tones to check bass and tweeter performance of left and right speakers.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>Is sound from affected speaker audible, clear, and free of distortion?</p>	No	Go to step 11.	\$(nodeText.noSymptomCode)	
11.	Inspect and carefully clean affected speaker cone using a soft tissue to remove dust, debris, or foreign material such as metal fragments that easily adhere to the magnetic speaker. Reseat speaker connection and retest.	Yes	Issue resolved by cleaning the speaker membrane. Verify resolution.	\$(nodeText.yesSymptomCode)	
	<p>Is sound from affected speaker audible, clear, and free of distortion?</p>	No	Go to step 12.	\$(nodeText.noSymptomCode)	
12.	To troubleshoot this issue completely, a known-good internal speaker set is required.	Yes	Go to step 13.	\$(nodeText.yesSymptomCode)	
	<p>Internal speakers are specified to work as a matched pair and must be tested or replaced as matched pairs.</p> <p>Keep and identify your known-good speakers from one kit as a matched pair.</p> <p>Do you have immediate access to a known-good speaker set?</p>	No	<p>Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit.</p> <p>Verify that the issue is resolved.</p>	X09	OTHER ELECTRIC

	Check	Result	Action	Code	Commodity
13.	Substitute a known-good internal speaker set and verify you can hear audio through internal speakers.	Yes	Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit.	X09	OTHER ELECTRIC
	Retest using AST 1 or AST 2 Audio Test to verify left and right speakers produce expected audio test patterns from each speaker.		Verify that the issue is resolved.		
	Refer to article TP587: Using Audio Test . Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.	No	Replace the logic board. Verify that the issue is resolved.	M09	MLB
14.	Does unit pass Audio Test?				
	Connect and disconnect headphones/external speakers. Verify that audio can be played through both external and internal speakers, and that sound is clear and free of distortion.	Yes	The issue is resolved. Verify resolution.	`\${nodeText.yesSymptomCode}`	
	Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved.	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
	Is the issue resolved?				

External Apple Bluetooth Peripherals

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Apple Bluetooth wireless keyboard, mouse, or trackpad is not recognized by known-good computer• Apple Bluetooth wireless keyboard, mouse, or trackpad will not pair with known-good computer• Apple Bluetooth wireless keyboard, mouse, or trackpad intermittently loses its connection• Apple wireless keyboard has one or more of the following issues:<ul style="list-style-type: none">◦ No power◦ Battery will not charge (for peripherals with embedded batteries)◦ Swollen battery (for peripherals with embedded batteries)◦ Battery runtime too short◦ Will not turn off◦ Specific key(s) do not work◦ Keys seem to stick, do not respond properly, or respond slowly◦ Wrong keyboard language◦ Keys missing or falling off keyboard◦ Paint is wearing off of one or more keys on the keyboard◦ Physical and/or cosmetic issues• Apple wireless mouse has one or more of the following issues:<ul style="list-style-type: none">◦ No power◦ Battery will not charge (for peripherals with embedded batteries)◦ Swollen battery (for peripherals with embedded batteries)◦ Battery runtime too short◦ Will not turn off◦ No mouse response◦ Mouse click not recognized◦ Mouse causes erratic cursor tracking◦ Physical and/or cosmetic issues• Apple wireless trackpad has one or more of the following issues:<ul style="list-style-type: none">◦ No power◦ Battery will not charge (for peripherals with embedded batteries)◦ Swollen battery (for peripherals with embedded batteries)◦ Battery runtime too short◦ Will not turn off◦ No trackpad response◦ Trackpad click not recognized◦ Trackpad causes erratic cursor tracking◦ Trackpad requires high click force◦ Trackpad click overly sensitive◦ Force Touch or haptic feedback issue◦ Physical and/or cosmetic issues <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>IMPORTANT: This troubleshooting procedure is intended only for Apple Bluetooth wireless peripheral devices, such as the following Apple products:</p> <ul style="list-style-type: none">• Magic Mouse or Magic Mouse 2• Magic Trackpad or Magic Trackpad 2• Apple Wireless Keyboard or Magic Keyboard <p>For simplicity, this procedure refers to these products as wireless mouse, wireless trackpad, and wireless keyboard unless otherwise noted.</p> <p>For third-party devices, contact the manufacturer for support, software/firmware updates, or service options.</p> <ol style="list-style-type: none">1. Check for and apply the latest software and firmware updates.2. In System Preferences, make sure Bluetooth is on and set to Discoverable.3. For Apple Bluetooth peripherals with replaceable batteries, such as the Magic Mouse, Magic Trackpad, or Apple Wireless Keyboard: If the device does not turn on, then install new or freshly charged batteries.4. For Apple Bluetooth peripherals with embedded batteries, such as the Magic Mouse 2, Magic Trackpad 2, or Magic Keyboard: If the device does not turn on, then connect a known-good USB Power Adapter and Lightning cable to the device to charge it for at least two minutes. Switching the device power button or switch to the ON position will allow the device to charge more quickly than when OFF.5. For Apple Bluetooth peripherals with embedded batteries such as the Magic Mouse 2, Magic Trackpad 2, or Magic Keyboard, verify that the computer being used with the peripheral supports Bluetooth 4.0 or later. Computers with earlier versions of Bluetooth support will not pair with Apple Bluetooth peripherals with embedded batteries.6. Reset Bluetooth device or delete pairing (if applicable).7. If Bluetooth pairs normally at your service location, then research potential sources of interference in the user's environment, such as microwave ovens or cordless phones in the 2.4/5GHz range. See article HT201542: Potential sources of Wi-Fi and Bluetooth interference.8. Magic Mouse 2, Magic Trackpad 2, and Magic Keyboard, can pair with the computer using either Bluetooth or a Lightning cable. If Bluetooth pairing is not possible due to interference or other reasons, then try pairing these products by connecting them to the known-good computer with a known-good Lightning cable.9. Follow steps listed in HT204066: Use Bluetooth Diagnostics to help you isolate issues with wireless devices.10. For keyboard issues, refer to HT204540: If your Apple keyboard doesn't work for troubleshooting tips.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Visually inspect the user's wireless mouse, wireless trackpad, or wireless keyboard for any for physical, cosmetic, and/or liquid damage.</p> <p>On a wireless mouse or wireless trackpad, verify that the mouse or trackpad button clicks.</p> <p>On keyboards, verify that all keyboard buttons are present and can be depressed normally.</p> <p>Does the user's wireless mouse, wireless trackpad, or wireless keyboard show signs of damage?</p>	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to step 11.	\$(nodeText.noSymptomCode)	
2.	<p>Determine whether there is a safety issue, such as fumes, excessive heat, or shock.</p> <p>Do not perform procedures that can be a safety risk to you or the user.</p> <p>Can you proceed safely?</p>	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support regarding safety procedures for this product.</p>	\$(nodeText.noSymptomCode)	
3.	<p>Isolate damage issue to either user's wireless keyboard, or wireless mouse or trackpad.</p> <p>Which peripheral is damaged?</p>	Wireless keyboard	Go to step 4.	\$(nodeText.yesSymptomCode)	
		Wireless mouse or trackpad	Go to step 8.	\$(nodeText.noSymptomCode)	
4.	<p>Closely examine the user's device to determine exact nature of the issue.</p> <p>Look for any signs of liquid spill, liquid penetration, or liquid damage to device.</p> <p>Is damage to user's device related to liquid spill?</p>	Yes	Replace the user's wireless keyboard out of warranty.	K90	KEYBOARD
		No	Go to step 5.	\$(nodeText.noSymptomCode)	
5.	<p>Closely examine the user's device for any signs of physical damage that may affect operation.</p> <p>Does the user's device exhibit this symptom?</p>	Yes	Replace the user's wireless keyboard out of warranty.	K16	KEYBOARD
		No	Go to step 6.	\$(nodeText.noSymptomCode)	
6.	<p>Closely examine the user's device for signs of paint wearing off of one or more keys.</p> <p>Does the user's device exhibit this symptom?</p>	Yes	Replace the user's wireless keyboard out of warranty.	K35	KEYBOARD
		No	Go to step 7.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
7.	Closely examine the user's device for any signs of cosmetic damage that does not affect operation.	Yes	Replace the user's wireless keyboard out of warranty.	K21	KEYBOARD
	Does the user's device exhibit this symptom?	No	Issue cannot be duplicated.	\$(nodeText.noSymptomCode)	
8.	Closely examine the user's device to determine exact nature of the issue.	Yes	Replace the user's wireless mouse or wireless trackpad out of warranty.	K90	MOUSE
	Look for any signs of liquid spill, liquid penetration, or liquid damage to device.	No	Go to step 9.	\$(nodeText.noSymptomCode)	
	Is damage to user's device related to liquid spill?				
9.	Closely examine the user's device for any signs of physical damage that may affect operation.	Yes	Replace the user's wireless mouse or wireless trackpad out of warranty.	K16	MOUSE
	Does the user's device exhibit this symptom?	No	Go to step 10.	\$(nodeText.noSymptomCode)	
10.	Closely examine the user's device for any signs of cosmetic damage that does not affect operation.	Yes	Replace the user's wireless mouse or wireless trackpad out of warranty.	K21	MOUSE
	Does the user's device exhibit this symptom?	No	Issue cannot be duplicated.	\$(nodeText.noSymptomCode)	
11.	Follow steps listed in HT201171: Using a Bluetooth mouse, keyboard, or trackpad with your Mac to pair the user's Bluetooth device with a known-good Mac.	Yes	ESCALATION REQUIRED. The Bluetooth device appears to be performing to specifications. There may be an issue with the user's computer, or wireless interference in user's environment. If issue persists, then contact ACS for additional support.	\$(nodeText.yesSymptomCode)	
	Test the user's wireless mouse, wireless trackpad, or wireless keyboard manually, using built-in applications on a known-good Mac. For example, use the Notes application to check the keys on a wireless keyboard.				
	Refer to HT204621: If your Apple wireless mouse, keyboard, or trackpad aren't working as expected for tips to resolve issues.				
12.	Does the user's wireless mouse, wireless trackpad, or wireless keyboard pair and function normally?	No	Go to step 12.	\$(nodeText.noSymptomCode)	
	Isolate failure to either user's wireless keyboard, or wireless mouse or trackpad.	Wireless keyboard	Go to step 13.	\$(nodeText.yesSymptomCode)	
	Which peripheral is malfunctioning?	Wireless mouse or trackpad	Go to step 29.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
13.	Look for for any signs of power on the user's wireless keyboard, such as a power LED turning on. Note: Not all devices have a power LED.	Yes	Go to step 14.	\$(nodeText.yesSymptomCode)	
	Verify that the user's wireless keyboard turns ON when the power button or switch is placed in the ON position. Verify that the user's wireless keyboard turns OFF when the power button or switch is placed in the OFF position. Does the user's wireless keyboard exhibit any power-related symptoms?	No	Go to step 18.	\$(nodeText.noSymptomCode)	
14.	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard is not functioning at all (seems dead, no power, power LED does not turn on) 	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K09	KEYBOARD
	Does the user's wireless keyboard exhibit this symptom?	No	Go to step 15.	\$(nodeText.noSymptomCode)	
15.	Verify that the user's wireless keyboard turns ON when the power button or switch is placed in the ON position. Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> Power switch or button is defective 	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K19	KEYBOARD
	Does the user's wireless keyboard exhibit this symptom?	No	Go to step 16.	\$(nodeText.noSymptomCode)	
16.	Verify that the user's wireless keyboard turns off when the power button or switch is placed in the OFF position. Confirm that the issue with the user's wireless keyboard is:	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K34	KEYBOARD
	<ul style="list-style-type: none"> User's wireless keyboard remains ON when power button or switch has been placed in the OFF position Does the user's wireless keyboard exhibit this symptom?	No	Go to step 17.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
17.	Verify if the user's wireless keyboard has any other power-related issue that is not related to the power button or switch.	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K20	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> Power Issue, not due to power button or switch Does the user's wireless keyboard exhibit this symptom?	No	Go to step 18.	\$(nodeText.noSymptomCode)	
18.	If the user's issue involves pairing or connecting to a Magic Keyboard, then you can connect to, pair, and use this device with the computer using either Bluetooth or a Lightning cable.	Yes	Go to step 19.	\$(nodeText.yesSymptomCode)	
	If Bluetooth pairing is not possible due to interference or other reasons, then try connecting the user's Magic Keyboard to the known-good computer with a known-good Lightning cable. For other Apple Bluetooth peripherals, select the "Yes" answer to continue. Does the user's Magic Keyboard connect and pair using USB?	No	Replace the user's wireless keyboard. Verify that the issue is resolved.	K30	KEYBOARD
19.	Verify that a known-good computer can recognize the user's wireless keyboard.	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K15	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard is not recognized by known-good computer Does the user's wireless keyboard exhibit this symptom?	No	Go to step 20.	\$(nodeText.noSymptomCode)	
20.	Verify that a known-good computer can pair with the user's wireless keyboard using Bluetooth.	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K07	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard cannot pair with a known-good computer Does the user's wireless keyboard exhibit this symptom?	No	Go to step 21.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
21.	Verify that a known-good computer maintains a Bluetooth connection to the user's wireless keyboard, and does not drop this connection.	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K08	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard intermittently loses its connection with a known-good computer Does the user's wireless keyboard exhibit this symptom?	No	Go to step 22.	\$(nodeText.noSymptomCode)	
22.	Ask the user how often and how long the wireless keyboard is used.	Yes	Go to step 23.	\$(nodeText.yesSymptomCode)	
	Explain to the user that the battery issue could likely be caused by the user using the wireless keyboard continuously over a long period of time, rather than any fault of the wireless keyboard itself, macOS, or the user's computer. Gain agreement from the user that lengthy wireless keyboard usage is likely to be the cause of the battery life issue, and that there is no service issue with the wireless keyboard itself. Does the user agree that the battery life issue is likely caused by lengthy wireless keyboard usage?	No	Replace the user's wireless keyboard. Verify that the issue is resolved.	K32	KEYBOARD
23.	Attempt to charge the user's wireless keyboard battery for several more minutes. Verify that the user's wireless keyboard battery charge level that appears on the known-good computer that is paired with this user's wireless keyboard has increased and shows that the user's wireless keyboard is charging.	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K31	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard battery will not charge Note: This symptom does not apply to peripherals with replaceable batteries. Does the user's wireless keyboard exhibit this symptom?	No	Go to step 24.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
24.	Closely inspect the user's wireless keyboard enclosure for signs of a swollen battery.	Yes	Replace the user's wireless keyboard.	K33	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard battery appears swollen <p>Note: This symptom does not apply to peripherals with replaceable batteries.</p> <p>Does the user's wireless keyboard exhibit this symptom?</p>		Verify that the issue is resolved.		
		No	Go to step 25.	\$(nodeText.noSymptomCode)	
25.	Verify that each and every wireless keyboard key functions as expected when pressed and released.	Yes	Replace the user's wireless keyboard.	K01	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> Specific key(s) do not work <p>Does the user's wireless keyboard exhibit this symptom?</p>		Verify that the issue is resolved.		
		No	Go to step 26.	\$(nodeText.noSymptomCode)	
26.	Verify that each and every wireless keyboard key functions as expected when pressed and released.	Yes	Replace the user's wireless keyboard.	K05	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> Keys seem to stick, do not respond properly, or respond slowly <p>Does the user's wireless keyboard exhibit this symptom?</p>		Verify that the issue is resolved.		
		No	Go to step 27.	\$(nodeText.noSymptomCode)	
27.	Verify that each and every wireless keyboard key is intact and not missing.	Yes	Replace the user's wireless keyboard.	K27	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> Keys missing or falling off keyboard <p>Does the user's wireless keyboard exhibit this symptom?</p>		Verify that the issue is resolved.		
		No	Go to step 28.	\$(nodeText.noSymptomCode)	
28.	Verify that the wireless keyboard language is as expected.	Yes	Replace the user's wireless keyboard.	K04	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> Wrong keyboard language version <p>Does the user's wireless keyboard exhibit this symptom?</p>		Verify that the issue is resolved.		
		No	Issue cannot be duplicated.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
29.	Look for for any signs of power on the user's wireless mouse or trackpad, such as a power LED turning on. Note: Not all devices have a power LED.	Yes	Go to step 30.	\$(nodeText.yesSymptomCode}	
	Verify that the user's wireless mouse or trackpad turns ON when the power button or switch is placed in the ON position.	No	Go to step 34.	\$(nodeText.noSymptomCode}	
	Verify that the user's wireless mouse or trackpad turns OFF when the power button or switch is placed in the OFF position.				
	Does the user's wireless mouse or trackpad exhibit any power-related symptoms?				
30.	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> User's wireless mouse or trackpad is not functioning at all (seems dead, no power, power LED does not turn on) 	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K09	MOUSE
	Does the user's wireless mouse or trackpad exhibit this symptom?	No	Go to step 31.	\$(nodeText.noSymptomCode}	
31.	Verify that the user's wireless mouse or trackpad turns ON when the power button or switch is placed in the ON position.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K19	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> Power switch or button is defective 	No	Go to step 32.	\$(nodeText.noSymptomCode}	
	Does the user's wireless mouse or trackpad exhibit this symptom?				
32.	Verify that the user's wireless mouse or trackpad turns off when the power button or switch is placed in the OFF position.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K34	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> User's wireless mouse or trackpad remains ON when power button or switch has been placed in the OFF position 	No	Go to step 33.	\$(nodeText.noSymptomCode}	
	Does the user's wireless mouse or trackpad exhibit this symptom?				

	Check	Result	Action	Code	Commodity
33.	Verify if the user's wireless mouse or trackpad has any other power-related issue that is not related to the power button or switch.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K20	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> Power Issue, not due to power button or switch Does the user's wireless mouse or trackpad exhibit this symptom?	No	Go to step 34.	\$(nodeText.noSymptomCode)	
34.	If the user's issue involves pairing or connecting to a Magic Mouse 2 or Magic Trackpad 2, then you can connect to and pair these devices with a computer using either Bluetooth or a Lightning cable.	Yes	Go to step 35.	\$(nodeText.yesSymptomCode)	
	If Bluetooth pairing is not possible due to interference or other reasons, then try connecting the user's Magic Mouse 2 or Magic Trackpad 2 to a known-good computer with a known-good Lightning cable. For other Apple Bluetooth peripherals, select the "Yes" answer to continue. Does the user's Magic Mouse 2 or Magic Trackpad 2 connect and pair using USB?	No	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K30	MOUSE
35.	Verify that a known-good computer can recognize the user's wireless mouse or trackpad.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K15	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> User's wireless mouse or trackpad is not recognized by known-good computer. Does the user's wireless mouse or trackpad exhibit this symptom?	No	Go to step 36.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
36.	Verify that a known-good computer can pair with the user's wireless mouse or trackpad.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K07	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> User's wireless mouse or trackpad cannot pair with a known-good computer Does the user's wireless mouse or trackpad exhibit this symptom?	No	Go to step 37.	\$(nodeText.noSymptomCode)	
37.	Verify that a known-good computer maintains a Bluetooth connection to the user's wireless mouse or trackpad, and does not drop this connection.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K08	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> User's wireless mouse or trackpad intermittently loses its connection with a known-good computer Does the user's wireless mouse or trackpad exhibit this symptom?	No	Go to step 38.	\$(nodeText.noSymptomCode)	
38.	Ask the user how often and how long the wireless mouse or trackpad is used.	Yes	Go to step 39.	\$(nodeText.yesSymptomCode)	
	Gain agreement from the user that lengthy wireless mouse or trackpad usage is likely to be the cause of the battery life issue, and that there is no service issue with the wireless mouse or trackpad itself. Does the user agree that the battery life issue is likely caused by lengthy wireless device usage?	No	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K32	MOUSE

	Check	Result	Action	Code	Commodity
39.	Attempt to charge the user's wireless mouse or trackpad battery for several more minutes. Verify that the user's wireless mouse or trackpad battery charge level that appears on the known-good computer that is paired with this user's wireless mouse or trackpad has increased and shows that the user's wireless mouse or trackpad is charging.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K31	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> User's wireless mouse or trackpad battery will not charge <p>Note: This symptom does not apply to peripherals with replaceable batteries.</p> <p>Does the user's wireless mouse or trackpad exhibit this symptom?</p>	No	Go to step 40.	\$(nodeText.noSymptomCode)	
40.	Closely inspect the user's wireless mouse or trackpad enclosure for signs of a swollen battery.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K33	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> User's wireless mouse or trackpad battery appears swollen <p>Note: This symptom does not apply to peripherals with replaceable batteries.</p> <p>Does the user's wireless mouse or trackpad exhibit this symptom?</p>	No	Go to step 41.	\$(nodeText.noSymptomCode)	
41.	Isolate failure to either user's wireless mouse or wireless trackpad.	Wireless mouse	Go to step 42.	\$(nodeText.yesSymptomCode)	
	Which peripheral is malfunctioning?	Wireless trackpad	Go to step 45.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
42.	Verify that the overall function of the user's wireless mouse performs as expected when used with the known-good computer.	Yes	Replace the user's wireless mouse. Verify that the issue is resolved.	K26	MOUSE
	Confirm that the issue with the user's wireless mouse is: <ul style="list-style-type: none"> No mouse response Does the user's wireless mouse exhibit this symptom?	No	Go to step 43.	\$(nodeText.noSymptomCode)	
43.	Verify that the clicking function of the user's wireless mouse performs as expected when pressed and released.	Yes	Replace the user's wireless mouse. Verify that the issue is resolved.	K14	MOUSE
	Confirm that the issue with the user's wireless mouse is: <ul style="list-style-type: none"> Mouse clicking function not working properly Does the user's wireless mouse exhibit this symptom?	No	Go to step 44.	\$(nodeText.noSymptomCode)	
44.	Verify that the touch gesture function of the user's wireless mouse performs as expected when the mouse surface is touched.	Yes	Replace the user's wireless mouse. Verify that the issue is resolved.	K18	MOUSE
	Confirm that the issue with the user's wireless mouse is: <ul style="list-style-type: none"> Touch/Multi-Touch gesture issue Does the user's wireless mouse exhibit this symptom?	No	Issue cannot be duplicated.	\$(nodeText.noSymptomCode)	
45.	Verify that the overall function of the user's wireless trackpad performs as expected when used with the known-good computer.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K23	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad cursor not responding Does the user's wireless trackpad exhibit this symptom?	No	Go to step 46.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
46.	Verify that the user's wireless trackpad exhibits smooth continuous tracking when used with the known-good computer, and does not skip or behave erratically.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K12	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad cursor not tracking properly Does the user's wireless trackpad exhibit this symptom?	No	Go to step 47.	\$(nodeText.noSymptomCode)	
47.	Verify that the clicking function of the user's wireless trackpad performs as expected when pressed and released, and that the click is recognized by the known-good computer.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K13	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad click not recognized Does the user's wireless trackpad exhibit this symptom?	No	Go to step 48.	\$(nodeText.noSymptomCode)	
48.	Verify that the user's wireless trackpad clicking function does not require excessive force when pressed and released.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K24	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad requires high click force Does the user's wireless trackpad exhibit this symptom?	No	Go to step 49.	\$(nodeText.noSymptomCode)	
49.	Verify that the user's wireless trackpad clicking function is not overly sensitive to clicking when pressed and released.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K25	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad click oversensitive Does the user's wireless trackpad exhibit this symptom?	No	Go to step 50.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
50.	Verify that the user's wireless trackpad Force Touch function performs as expected and that haptic feedback is felt in response. Note: This feature does not apply to all models.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K29	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad Force Touch or haptic feedback issue Does the user's wireless trackpad exhibit this symptom?	No	Issue cannot be duplicated.	\${nodeText.noSymptomCode}	

External Apple Wired Keyboard and Mouse

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<p>Apple wired USB keyboard or mouse does not function with user's computer, or shows one or more of the following symptoms:</p> <ul style="list-style-type: none">• Mouse button(s) does not click• Mouse scroll ball does not operate smoothly• No mouse response• Keyboard keys stick• Keyboard keys loose or missing• One or more keys do not respond when pressed• No keyboard response at all• Apple wired mouse causes erratic cursor tracking• Apple wired keyboard or mouse is not recognized• Apple wired keyboard or mouse has physical damage that affects operation• Paint is wearing off of one or more keys on the keyboard• Apple wired keyboard or mouse has cosmetic damage that does not affect operation <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Disconnect all USB devices from the user's computer except for the user's mouse or keyboard. Troubleshoot only one device at a time to help isolate the issue.2. Unplug the keyboard or mouse from the USB port, wait a few seconds, and reconnect it.3. Connect the keyboard or mouse to another USB port on the user's computer.4. Make sure the USB connectors are plugged in completely and correctly.5. Visually inspect the USB connectors and ports for damage or debris.6. Try operating the user's mouse on another surface. Ask the user about the type of surface usually being used with the mouse. Glossy or transparent surfaces, or those with repetitive patterns, may cause mouse-tracking errors or faulty mouse operation. Explain that solid, non-reflective, opaque surfaces work best. The surface should be clean, but not shiny.7. Visually inspect the user's keyboard or mouse for dirt, hair, liquid damage, or other debris. Check to see if the user has pets. Pet hair can lay across the laser and cause intermittent mouse issues. Refer to article HT204172: How to clean your Apple products for information on cleaning the user's keyboard or mouse.8. Connect the user's USB keyboard or mouse to an available USB port on a known-good computer to determine if the issue is related to the USB port on the user's computer, or to the user's USB keyboard or mouse. If the user's keyboard or mouse functions when used with a known-good computer, go to the “USB Port Not Recognized” troubleshooting flow.9. For keyboard issues, refer to HT204540: If your Apple keyboard doesn't work for troubleshooting tips.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Visually inspect the user's USB mouse or keyboard to verify that the attached USB cable and/or connector is not damaged or frayed.</p> <p>Check the user's keyboard or mouse for physical and/or liquid damage.</p> <p>On mice, verify that all mouse buttons click and the laser tracking LED illuminates.</p> <p>On keyboards, verify that all keyboard buttons are present and can be depressed normally.</p> <p>Does the user's USB mouse or keyboard, or its attached cable or connector, show signs of damage?</p>	Yes	Go to step 2.	\${nodeText.yesSymptomCode}	
		No	Go to step 12.	\${nodeText.noSymptomCode}	
2.	<p>Isolate the damage issue to either the user's wired USB keyboard or mouse.</p> <p>Which peripheral is damaged?</p>	USB Keyboard	Go to step 3.	\${nodeText.yesSymptomCode}	
		USB Mouse	Go to step 9.	\${nodeText.noSymptomCode}	
3.	<p>Closely examine the user's keyboard to determine the exact nature of its issue.</p> <p>Look for any signs of liquid spill, liquid penetration, or liquid damage to the keyboard.</p> <p>Is damage to the user's keyboard related to liquid spill?</p>	Yes	<p>Replace USB keyboard. Verify issue resolved.</p> <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K90	KEYBOARD
		No	Go to step 4.	\${nodeText.noSymptomCode}	
4.	<p>Click each key to ensure all keys are not sticking in the down or up position.</p> <p>Is damage to the user's keyboard related to sticky keys or slow key response?</p>	Yes	<p>Replace USB keyboard. Verify issue resolved.</p> <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K05	KEYBOARD
		No	Go to step 5.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
5.	Look for any loose or missing keycaps. Is damage to the user's keyboard related to loose or missing keycaps?	Yes	Replace USB keyboard. Verify issue resolved. Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.	K27	KEYBOARD
		No	Go to step 6.	\${nodeText.noSymptomCode}	
6.	Closely inspect the keyboard for any signs of physical damage that may affect operation. Does the user's keyboard exhibit this symptom?	Yes	Replace USB keyboard. Verify issue resolved. Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.	K16	KEYBOARD
		No	Go to Step 7.	\${nodeText.noSymptomCode}	
7.	Closely examine the keyboard for signs of paint wearing off of one or more keys. Does the user's keyboard exhibit this symptom?	Yes	Replace USB keyboard. Verify issue resolved. Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.	K35	KEYBOARD
		No	Go to step 8.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
8.	<p>Closely inspect the keyboard for any signs of cosmetic damage that does not affect operation.</p> <p>Does the user's keyboard exhibit this symptom?</p>	Yes	<p>Replace USB keyboard. Verify issue resolved.</p> <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K21	KEYBOARD
		No	Issue cannot be duplicated.	<p> <code> \${nodeText.noSymptomCode} </code> </p>	
9.	<p>Closely examine user's mouse to determine exact nature of the issue.</p> <p>Look for any signs of liquid spill, liquid penetration, or liquid damage to mouse.</p> <p>Is damage to user's mouse related to liquid spill?</p>	Yes	<p>Replace USB mouse. Verify issue resolved.</p> <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K90	MOUSE
		No	Go to step 10.	<p> <code> \${nodeText.noSymptomCode} </code> </p>	
10.	<p>Closely inspect the mouse for any signs of physical damage that may affect operation.</p> <p>Is there physical damage to user's mouse?</p>	Yes	<p>Replace USB mouse. Verify issue resolved.</p> <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K16	MOUSE
		No	Go to step 11.	<p> <code> \${nodeText.noSymptomCode} </code> </p>	

	Check	Result	Action	Code	Commodity
11.	Closely inspect the mouse for any signs of cosmetic damage that does not affect operation.	Yes	Replace USB mouse. Verify issue resolved. Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.	K21	MOUSE
	Is there cosmetic damage to user's mouse?	No	Issue cannot be duplicated.	\${nodeText.noSymptomCode}	
12.	Isolate failure issue to either user's wired USB keyboard or mouse.	USB Keyboard	Go to step 17.	\${nodeText.yesSymptomCode}	
	Which peripheral is malfunctioning?	USB Mouse	Gp to step 13.	\${nodeText.noSymptomCode}	
13.	Connect user's USB mouse to a free USB port on a known-good computer, and check System Information to determine whether the computer recognizes the mouse.	Yes	Go to step 14.	\${nodeText.yesSymptomCode}	
	Is mouse recognized by a known-good computer?	No	Replace USB mouse. Verify issue resolved.	K15	MOUSE
14.	Move the mouse and verify that the cursor on the known-good computer screen moves smoothly.	Yes	Replace USB mouse. Verify issue resolved.	K26	MOUSE
	Is issue related to mouse function?	No	Go to step 15.	\${nodeText.noSymptomCode}	
15.	Click and roll the mouse's scroll ball to check that it rolls freely in all directions, with no physical resistance.	Yes	Replace USB mouse. Verify issue resolved.	K06	MOUSE
	Is issue related to the scroll ball?	No	Go to step 16.	\${nodeText.noSymptomCode}	
16.	Click the mouse's various buttons to verify they click properly, without sticking, each time they are pressed.	Yes	Replace USB mouse. Verify issue resolved.	K14	MOUSE
	Is issue related to the mouse button(s)?	No	Issue cannot be duplicated.	\${nodeText.noSymptomCode}	
17.	Connect user's USB keyboard to a free USB port on a known-good computer, and check System Information to determine whether the computer recognizes the keyboard.	Yes	Go to step 18.	\${nodeText.yesSymptomCode}	
	Is keyboard recognized by a known-good computer?	No	Replace USB keyboard. Verify issue resolved.	K15	KEYBOARD

	Check	Result	Action	Code	Commodity
18.	Verify that each and every keyboard key functions as expected when pressed and released.	Yes	Replace USB keyboard. Verify issue resolved.	K01	KEYBOARD
	Is issue related to specific keys not working?	No	Go to step 19.	\${nodeText.noSymptomCode}	
19.	Verify that the keyboard language is as expected.	Yes	Replace USB keyboard. Verify issue resolved.	K04	KEYBOARD
	Is issue related to keyboard language?	No	Issue cannot be duplicated.	\${nodeText.noSymptomCode}	

Internal Microphone Issues

Unlikely causes:

Battery, camera/front microphone/ALS cable, DisplayPort cable, fan, flash storage card, left speaker, memory, power supply, right speaker, stand, Wi-Fi/Bluetooth antenna(s)

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Microphone not working, but audio output is functional• Microphone audio is garbled• Internal microphone input cannot be selected• Line audio input functions properly <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Identify the locations of all microphones (top front of display next to camera, and on upper-rear enclosure), and check that the microphone openings are not covered by tape, sticky notes, or other obstructions. Attempt to carefully remove any obstructions and verify this resolves the issue.2. On user's computer go to System Preferences > Sound and verify the following:<ul style="list-style-type: none">• Input tab:<ul style="list-style-type: none">◦ "Internal microphone" source is available and selected.◦ Input volume slider is not set to zero.• Output tab:<ul style="list-style-type: none">◦ Sound output device is set to Internal Speakers.◦ Output volume is not muted or set to zero.3. Go to System Preferences > Sound > Input tab, and verify that "Input level" indicator moves when speaking into microphone.4. Launch QuickTime Player. Choose New Audio Recording from File menu. Choose Built-in Microphone from right pop-up menu, and adjust input volume using slider in center of window.5. Check that no cables are inserted into audio input or output jacks. Use an otoscope to visually inspect both jacks. Use compressed air to clean and remove any debris.6. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.7. Refer to HT201260: How to find the macOS version number on your Mac to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. <p>Warning: Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP1620: iMac Pro (2017): Power Supply Cover Instructions• TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Follow steps listed in HT208198: About Boot Security Utility to enable starting up from an external storage device on the user's computer.</p> <p>Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT201260: How to find the macOS version number on your Mac.</p> <p>Retest for microphone issues.</p> <p>Does issue persist with a known-good OS?</p>	Yes	Go to step 2.	\$(nodeText.yesSymptomCode}	
		No	Reinstall macOS on the user's computer. Refer to HT201260: How to find the macOS version number on your Mac to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	\$(nodeText.noSymptomCode}	
2.	<p>Disconnect any connected headphones or external speakers. Check whether System Preferences > Sound > Input tab shows an "Internal microphone" source available and selected.</p> <p>Does System Preferences list "External microphone" instead?</p>	Yes	Go to step 4.	\$(nodeText.yesSymptomCode}	
		No	Go to step 3.	\$(nodeText.noSymptomCode}	
3.	<p>Run AST 2 Audio Test to verify that built-in microphones detect expected audio test patterns produced from each speaker.</p> <p>Refer to article TP587: Using Audio Test.</p> <p>Does unit pass AST 2 Audio Test?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
		No	Go to step 4.	\$(nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
4.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Go to step 5.	\${nodeText.yesSymptomCode}	
	Remove display panel. Locate and disconnect the camera/front microphone/ALS cable from the logic board and camera. Inspect both ends of the cable, the logic board connector, and the camera connector for any damage. Is there any damage to the camera/front microphone/ALS cable or any connectors?	No	Go to step 6.	\${nodeText.noSymptomCode}	
5.	Determine whether the damage is located on the camera/front microphone/ALS cable, the logic board, the camera, or a combination of multiple components.	Yes	Replace the camera/front microphone/ALS cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
	Is the damage limited to the camera/front microphone/ALS cable cable only?	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
6.	Locate and disconnect the rear microphone cable from the logic board and rear microphone board.	Yes	Go to step 7.	\${nodeText.yesSymptomCode}	
	Inspect both ends of the cable, the logic board connector, and the rear microphone board connector for any damage. Is there any damage to the rear microphone cable or any connectors?	No	Go to step 8.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
7.	<p>Determine whether the damage is rear microphone cable, the logic board, the rear microphone board, or a combination of multiple components.</p> <p>Is the damage limited to the rear microphone cable only?</p>	Yes	<p>Replace the rear microphone cable.</p> <p>Verify that the issue is resolved.</p>	X03	INTERNAL CABLE
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
8.	<p>Reseat camera/front microphone/ALS cable securely to logic board and camera.</p> <p>Reseat rear microphone cable securely to logic board and rear microphone board.</p> <p>Retest by going to System Preferences > Sound > Input tab, and verifying that the input level indicator moves when speaking into the microphone.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>Is the microphone recognized and functional?</p>	Yes	Go to step 13.	\${nodeText.yesSymptomCode}	
		No	Go to step 9.	\${nodeText.noSymptomCode}	
9.	<p>To troubleshoot this issue completely, a known-good camera/front microphone/ALS cable is required.</p> <p>Do you have immediate access to a known-good camera/front microphone/ALS cable?</p>	Yes	Go to step 10.	\${nodeText.yesSymptomCode}	
		No	<p>Replace camera/front microphone/ALS cable.</p> <p>Verify that the issue is resolved.</p>	X03	INTERNAL CABLE
10.	<p>Substitute a known-good camera/front microphone/ALS cable and retest.</p> <p>Is the microphone recognized and functional?</p>	Yes	<p>Replace camera/front microphone/ALS cable.</p> <p>Verify that the issue is resolved.</p>	X03	INTERNAL CABLE
		No	Go to step 11.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
11.	To troubleshoot this issue completely, a known-good rear microphone cable is required. Do you have immediate access to a known-good rear microphone cable?	Yes	Go to step 12.	\$(nodeText.yesSymptomCode}	
		No	Replace rear microphone cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
12.	Substitute a known-good rear microphone cable and retest. Is the microphone recognized and functional?	Yes	Replace rear microphone cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
		No	Go to step 13.	\$(nodeText.noSymptomCode}	
13.	Run AST 2 Audio Test to verify that built-in microphones detect expected audio test patterns produced from each speaker. Refer to article TP587: Using Audio Test . Does unit pass AST 2 Audio Test?	Yes	The issue was resolved by reseating microphone cables. Verify resolution.	\$(nodeText.yesSymptomCode}	
		No	Go to step 14.	\$(nodeText.noSymptomCode}	
14.	Determine which component failed the diagnostic test: rear microphones or front microphones. If the speaker tests failed, then return to the list of symptoms and select “ No Audio from Internal Speakers or Headphone Jack ” from the troubleshooting menu. Which microphones failed the audio test?	Front	Go to step 15.	\$(nodeText.yesSymptomCode}	
		Rear	ESCALATION REQUIRED. Rear microphones are part of rear enclosure. Replace rear enclosure. Verify issue resolved. Rear cover replacement is not normally covered by Apple’s one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty . If the microphone issue was not caused by accidental damage, then contact ACS for additional support regarding warranty coverage for this part.	\$(nodeText.noSymptomCode}	
15.	Front microphones are part of the display panel in this model. To troubleshoot this issue completely, a known-good display panel is required. Do you have immediate access to a known-good display panel?	Yes	Go to step 16.	\$(nodeText.yesSymptomCode}	
		No	Replace display panel, which includes the front microphones. Verify issue resolved.	L11	LCD

	Check	Result	Action	Code	Commodity
16.	Substitute a known-good display panel and retest. Is camera working normally?	Yes	Replace display panel, which includes the front microphones. Verify issue resolved.	L11	LCD
		No	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M09	MLB
17.	Verify that the "Internal microphone" device is available, selected, and functional, and that the input level indicator moves when speaking into the microphone. Then record a sample audio file and play it back to verify that it is free of distortion. Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Is issue resolved?	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	M99	

No Audio from Internal Speaker(s) or Headphone Jack

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, DisplayPort cable, fan, hard disk drive (HDD), hard drive data or power or combo cable, display panel, memory, power supply, solid state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antennas, wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• No sound from internal speaker(s).• No sound from left and/or right speaker channel.• No sound from headphone jack. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Adjust volume controls to verify setting is above minimum, and audio is not muted.2. Test with known-good stereo sound file.3. Check that nothing is inserted into external audio port. Use an otoscope to visually inspect the port. Use compressed air to clean and remove any debris.4. Connect headphones or external speakers to external audio port. Verify in System Preferences > Sound > Output that Audio Out setting switches to Headphones, and whether audio can be played on external speakers.5. Disconnect any device connected to external audio port. In System Preferences > Sound > Output, check that sound output device reverts to Internal Speakers. Use Balance slider to isolate left and right speakers and check whether issue is limited to one speaker.6. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.7. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer versions to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none">• TP1620: iMac Pro (2017): Power Supply Cover Instructions• TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version.</p> <p>Does the audio issue persist from a known-good OS?</p>	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Reinstall macOS on the user's computer. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	\$(nodeText.noSymptomCode)	
2.	<p>Connect headphones or external speakers to computer and retest. Adjust volume setting to verify audio out to headphones/external speakers.</p> <p>Can you hear audio through headphones/external speakers?</p>	Yes	Go to step 7.	\$(nodeText.yesSymptomCode)	
		No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Inspect audio cable to audio I/O ports and its corresponding connection on logic board.</p> <p>Did you find damage to audio cable or logic board connector?</p>	Yes	Go to step 4.	\$(nodeText.yesSymptomCode)	
		No	Go to step 5.	\$(nodeText.noSymptomCode)	
4.	<p>Determine whether damage is on the logic board, audio cable, or both.</p> <p>Is the damage limited to logic board?</p>	Yes	Replace the logic board. Verify that the issue is resolved.	M09	MLB
		No	<p>ESCALATION REQUIRED.</p> <p>Audio I/O ports are part of the rear enclosure. Replace the rear enclosure. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
5.	To troubleshoot this issue completely, a known-good logic board is required.	Yes	Go to step 6.	\${nodeText.yesSymptomCode}	
	Do you have immediate access to a known-good logic board?	No	Replace the logic board. Verify that the issue is resolved.	M09	MLB
6.	Substitute known-good logic board and retest. Can you hear audio through headphones/external speakers?	Yes	Replace the logic board. Verify that the issue is resolved.	M09	MLB
		No	<p>ESCALATION REQUIRED.</p> <p>Audio I/O ports are part of the rear enclosure. Replace the rear enclosure. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>Contact ACS for additional support regarding warranty coverage for this part.</p>	\${nodeText.noSymptomCode}	
7.	Run AST 1 or AST 2 Audio Test to verify left and right speakers produce expected audio test patterns from each speaker.	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
	Refer to article TP587: Using Audio Test .				
	Does unit pass Audio Test?	No	Go to step 8.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
8.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Locate speaker connections on logic board. Disconnect and inspect both speaker cable connectors and corresponding connectors on logic board for damage.</p> <p>Reconnect the left and right speakers to the logic board, verifying that the connections are all seated properly.</p> <p>Did you find damage to speakers or logic board connector?</p>	Yes	Go to step 9.	\${nodeText.yesSymptomCode}	
		No	Go to step 10.	\${nodeText.noSymptomCode}	
9.	<p>Determine whether damage is on the logic board, speakers, or both.</p> <p>Is the damage limited to speaker(s)?</p>	Yes	<p>Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit.</p> <p>Verify that the issue is resolved.</p>	X08	OTHER ELECTRIC
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

	Check	Result	Action	Code	Commodity
10.	With speaker connectors reseated to logic board, verify you can hear audio through internal speakers.	Yes	The issue was resolved by reseating cables. Verify resolution.	`\${nodeText.yesSymptomCode}`	
	<p>In System Preferences > Sound > Output tab, adjust Balance slider to check left and right speaker channel separation.</p> <p>Play music with high and low tones to check bass and tweeter performance of left and right speakers.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>Do internal speakers present full range of expected audio performance?</p>	No	Go to step 11.	`\${nodeText.noSymptomCode}`	
11.	To troubleshoot this issue completely, a known-good internal speaker set is required.	Yes	Go to step 12.	`\${nodeText.yesSymptomCode}`	
	<p>Internal speakers are specified to work as a matched pair and must be tested or replaced as matched pairs.</p> <p>Keep and identify your known-good speakers from one kit as a matched pair.</p> <p>Do you have immediate access to a known-good speaker set?</p>	No	<p>Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit.</p> <p>Verify that the issue is resolved.</p>	X08	OTHER ELECTRIC

	Check	Result	Action	Code	Commodity
12.	Substitute a known-good internal speaker set and verify you can hear audio through internal speakers.	Yes	Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit.	X08	OTHER ELECTRIC
	Retest using AST 1 or AST 2 Audio Test to verify left and right speakers produce expected audio test patterns from each speaker.		Verify that the issue is resolved.		
	Refer to article TP587: Using Audio Test . Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.	No	Replace the logic board. Verify that the issue is resolved.	M09	MLB
13.	Does unit pass Audio Test?				
	Connect and disconnect headphones/external speakers. Verify that audio can be played through both external and internal speakers, and that sound is clear and free of distortion.	Yes	The issue is resolved. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
	Is the issue resolved?				

No Audio to External Display Speakers

Unlikely causes:

Battery, camera, camera cable, fan, DisplayPort cable, hard disk drive (HDD), HDD combo cable, display panel, left speaker, memory, power supply, rear enclosure, right speaker, flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"> • Video but no audio to external display; audio works on internal speakers <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"> 1. Gather display type and model information from the user. 2. Always use a known-good USB-C Digital AV Multiport Adapter and known-good HDMI display equipped with internal speaker(s) to verify the computer. Review article HT201853: About Apple video adapters and cables to help identify which adapters can be used with this computer model. 3. In System Preferences > Sound > Output, select the available DisplayPort, Thunderbolt, HDMI, or USB output device type (the output name varies depending on the display model). 4. On the HDMI display, verify that the correct input has been selected. 5. Connect the video adapter to each USB-C connector on the computer and retest each time, to isolate a possible faulty USB-C port on the user's computer. 6. Test the audio output using more than one application or website. 7. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac. 8. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. 9. With the user's USB-C Digital AV Multiport Adapter or USB-C Digital AV VGA Adapter connected to the computer, check for and apply the latest software and firmware updates. 10. Refer to the following articles to learn more about Thunderbolt connectivity in this computer: <ul style="list-style-type: none"> • HT204154: About Thunderbolt ports and displays • HT202488: About Apple Thunderbolt cables and adapters <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP833: iMac and Displays: Power Supply Cover Instructions • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none"> • TP1620: iMac Pro (2017): Power Supply Cover Instructions • TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Connect the known-good display, HDMI cable, and USB-C Digital AV Multiport Adapter to the user's computer.</p> <p>Check System Preferences > Sound > Output for an available DisplayPort output device type. Select the available device type, adjust the volume level on the display, and play the audio file or source.</p> <p>Disconnect the USB-C plug, then flip it over and reconnect to test both orientations.</p> <p>Can the external display audio be selected and play audio in both plug orientations?</p>	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to step 3.	\$(nodeText.noSymptomCode)	
2.	<p>Connect the known-good display and HDMI cable to the user's USB-C Digital AV Multiport Adapter, then to the computer.</p> <p>Check System Preferences > Sound > Output for an available HDMI output device type. Select the available device type, adjust the volume level on the display, and play the audio file or source.</p> <p>Disconnect the USB-C plug, then flip it over and reconnect to test both orientations.</p> <p>Can the external display audio be selected and play audio in both plug orientations?</p>	Yes	<p>The issue is isolated to the user's display or HDMI cable. Inform the user of findings and refer to article HT204388: Frequently asked questions about using HDMI with Mac computers for more information.</p>	\$(nodeText.yesSymptomCode)	
		No	<p>The issue is isolated to the user's adapter.</p> <p>Replace the user's USB-C Digital AV Multiport Adapter or USB-C Digital AV VGA Adapter.</p> <p>If user has third-party adapter, refer to manufacturer for support.</p>	X03	EXTERNAL CABLE

	Check	Result	Action	Code	Commodity
3.	Start up the user's computer using a known-good, up-to-date, and bootable macOS volume.	Yes	Reinstall macOS on the user's computer. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	{nodeText.yesSymptomCode}	
	Connect the known-good display, HDMI cable, and USB-C Digital AV Multiport Adapter to the user's computer.				
	Check System Preferences > Sound > Output for an available DisplayPort, HDMI, or USB Output device type. Select the available device type, adjust the output volume level, and play the audio file or source.	No	Go to step 4.	{nodeText.noSymptomCode}	
	Can the external display audio be selected and play audio from a known-good OS?				
4.	Inspect all USB-C receptacles and rear enclosure openings on the user's computer for any signs of deformation, damage, or debris that may be blocking the connection. Use compressed air to clear any obstructions or debris.	Yes	Go to step 5.	{nodeText.yesSymptomCode}	
	Important: Do not use any metal objects to clear debris or obstructions, as this can short the connector and cause damage.	No	Replace logic board. Verify that the issue is resolved.	M09	MLB
5.	Is any USB-C port damaged?	Yes	Replace the rear enclosure. Verify that the issue is resolved.	X13	ENCLOSURE
	Inspect the opening on the rear enclosure for the USB-C receptacle. Determine whether the opening is misshapen or deformed, preventing proper insertion of the USB-C plugs.				
	Is the opening for the USB-C port damaged or deformed?	No	Replace logic board. Verify that the issue is resolved.	M24	MLB
6.	Play a known-good audio file or source and verify that the sound output to display speakers is functional.	Yes	The issue is resolved. Verify resolution.	{nodeText.yesSymptomCode}	
	Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
	Verify that the issue is resolved.				
	Is issue resolved?				

No Video to External Display

Unlikely causes:

Battery, camera, camera cable, fan, DisplayPort cable, hard disk drive (HDD), HDD combo cable, display panel, left speaker, memory, power supply, right speaker, flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"> External display is not detected when connected to computer External display does not show any video <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"> Gather display type and model information from the user. Always use a known-good USB-C Digital AV Multiport Adapter and known-good HDMI display equipped with internal speaker(s) to verify the computer. Review article HT201853: About Apple video adapters and cables to help identify which adapters can be used with this computer model. Refer to article HT201177: Get help with video issues on external displays connected to your Mac for common causes of video issues. On the HDMI display, verify that the correct input has been selected. Connect the video adapter to each USB-C connector on the computer and retest each time, to isolate a possible faulty USB-C port on the user's computer. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac. Reset the SMC using the procedure for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac. Retest for external video issues. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. With the user's USB-C Digital AV Multiport Adapter or USB-C Digital AV VGA Adapter connected to the computer, check for and apply the latest software and firmware updates. Refer to the following articles to learn more about Thunderbolt connectivity in this computer: <ul style="list-style-type: none"> HT204154: About Thunderbolt ports and displays HT202488: About Apple Thunderbolt cables and adapters <p>Warning: Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> TP833: iMac and Displays: Power Supply Cover Instructions TP820: iMac (27-inch): Safety TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none"> TP1620: iMac Pro (2017): Power Supply Cover Instructions TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Connect the known-good display, HDMI cable, and USB-C Digital AV Multiport Adapter to the user's computer.</p> <p>Check System Preferences > Displays for an available external HDMI display type. Select the available device type.</p> <p>Verify that the external display can be selected and that a good image appears on the external display.</p> <p>Disconnect the USB-C plug, then flip it over and reconnect to test both orientations.</p> <p>Does a good image appear on the external display in both plug orientations?</p>	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to step 3.	\$(nodeText.noSymptomCode)	
2.	<p>Connect the known-good display and HDMI cable to the user's USB-C Digital AV Multiport Adapter, then to the computer.</p> <p>Check System Preferences > Displays for an available external HDMI display type. Select the available device type.</p> <p>Verify that the external display can be selected and that a good image appears on the external display.</p> <p>Disconnect the USB-C plug, then flip it over and reconnect to test both orientations.</p> <p>Does a good image appear on the external display in both plug orientations?</p>	Yes	<p>The issue is isolated to the user's display or HDMI cable. Inform the user of findings and refer to article HT204388: Mac computers: Frequently asked questions about using HDMI for more information.</p>	\$(nodeText.yesSymptomCode)	
		No	<p>The issue is isolated to the user's adapter.</p> <p>Replace the user's USB-C Digital AV Multiport Adapter or USB-C Digital AV VGA Adapter.</p> <p>If user has third-party adapter, refer to manufacturer for support.</p>	X03	EXTERNAL CABLE

	Check	Result	Action	Code	Commodity
3.	<p>Start up the user's computer using a known-good, up-to-date, and bootable macOS volume.</p> <p>Connect the known-good display, HDMI cable, and USB-C Digital AV Multiport Adapter to the user's computer.</p> <p>Check System Preferences > Displays for an available external HDMI display type. Select the available device type.</p> <p>Verify that the external display can be selected and that a good image appears on the external display.</p>	Yes	Reinstall macOS on the user's computer. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Does a good image appear on the external display?	No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	<p>Inspect all USB-C receptacles and rear enclosure openings on the user's computer for any signs of deformation, damage, or debris that may be blocking the connection. Use compressed air to clear any obstructions or debris.</p> <p>Important: Do not use any metal objects to clear debris or obstructions, as this can short the connector and cause damage.</p>	Yes	Go to step 5.	\$(nodeText.yesSymptomCode)	
	Is any USB-C port damaged?	No	<p>Replace logic board.</p> <p>Verify that the issue is resolved.</p>	M26	MLB
5.	<p>Inspect the opening on the rear enclosure for the USB-C receptacle. Determine whether the opening is misshapen or deformed, preventing proper insertion of the USB-C plugs.</p>	Yes	<p>Replace the rear enclosure.</p> <p>Verify that the issue is resolved.</p>	X13	ENCLOSURE
	Is the opening for the USB-C port damaged or deformed?	No	<p>Replace logic board.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
6.	<p>Restart the computer and verify that a known-good external display works over both VGA and digital AV adapters.</p>	Yes	The issue is resolved. Verify resolution.	\$(nodeText.yesSymptomCode)	
	<p>Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is issue resolved?</p>	No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

USB Port Not Recognized

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, fan, DisplayPort cable, hard disk drive (HDD), hard drive data or power or combo cable, display panel, left speaker, memory, power supply, rear enclosure, right speaker, solid-state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Standard USB devices not recognized or not powered. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">Disconnect all USB devices.Verify that the user's USB device is compatible with the computer. Refer to HT201163: Using USB devices with your Mac for more information about compatibility with various USB devices.Verify that any USB hubs connected to the computer have sufficient power for a connected USB device.Check to see whether the user's USB device requires a specific driver to function properly.Check System Information > USB device tree to see whether the computer recognizes internal USB devices (Bluetooth, IR, camera).Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac.Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure the system build is correct for this computer model. Check for and apply the latest software and firmware updates.Test each USB port using a known-good Apple wired keyboard or mouse.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect USB ports for lint, debris, or other foreign material. Remove debris with an anti-static brush.	Yes	Issue resolved. Return computer to user, explaining that debris in USB port caused issue and what to do to prevent contamination in the future.	\$(nodeText.yesSymptomCode)	
	Is known-good Apple USB device functional and recognized?	No	Go to step 2.	\$(nodeText.noSymptomCode)	
2.	Inspect all USB receptacles and rear enclosure openings on the user's computer for any signs of deformation, damage, or debris that may be blocking the connection.	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
	Is any USB port damaged?	No	Go to step 4.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
3.	Inspect the opening on the rear enclosure for the USB receptacle. Determine whether the opening is misshapen or deformed, preventing proper insertion of the USB plugs.	Yes	Replace the rear enclosure. Verify that the issue is resolved.	X13	ENCLOSURE
	Is the opening for the USB port damaged or deformed?	No	Replace logic board. Verify that the issue is resolved.	M24	MLB
4.	Disconnect all USB devices. Verify whether known-good Apple wired keyboard or mouse functions correctly and is recognized in System Information > USB device tree.	Yes	Go to step 7.	\$(nodeText.yesSymptomCode)	
	Is known-good Apple USB device functional and recognized?	No	Go to step 5.	\$(nodeText.noSymptomCode)	
5.	Continue to use known-good Apple wired keyboard or mouse. Start up computer using known-good, up-to-date, bootable macOS volume. Verify whether known-good USB device functions correctly and is recognized in System Information > USB device tree.	Yes	Go to step 6.	\$(nodeText.yesSymptomCode)	
	Is a known-good Apple USB device functional and recognized?	No	Replace logic board. Verify that the issue is resolved.	M15	MLB
6.		Yes	Issue resolved by directory repair in Disk Utility. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Use Disk Utility to repair the file directory on internal hard drive. Restart and verify whether a known-good USB device functions correctly and is recognized in System Information > USB device tree. Is known-good Apple USB device functional and recognized?	No	Reinstall macOS on the user's computer. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
7.	<p>This computer can support one high-powered USB device (iPad, iPhone, or USB hard drive for example) at a time.</p> <p>Note: The first USB device to draw more than 900 mA is allotted up to 1100 mA, while all subsequent devices are limited to 900 mA. See article HT204377: Powering peripherals through USB for more information.</p> <p>Do you have immediate access to a known-good, high-powered USB device that draws over 900 mA?</p>	Yes	Go to step 8.	\$(nodeText.yesSymptomCode)	
		No	Go to step 10.	\$(nodeText.noSymptomCode)	
8.	<p>Connect known-good, high-powered USB device to one of the computer's USB ports. In System Information > USB device tree, "Current Available (mA)" and "Extra Operating Current (mA)" should each report 900 mA.</p> <p>Note: The first USB device to draw more than 900 mA is allotted up to 1100 mA, while all subsequent devices are limited to 900 mA. Verify that known-good USB device functions as expected.</p> <p>Does "Extra Operating Current" appear in System Information?</p>	Yes	Go to step 9.	\$(nodeText.yesSymptomCode)	
		No	Replace logic board. Verify issue resolved.	M38	MLB
9.	<p>Connect exact same high-powered USB device to next USB port. Make sure nothing is plugged into other port(s). Both "Current Available (mA)" and "Extra Operating Current (mA)" should each report 900 mA in System Information. Repeat action with every available USB port.</p> <p>Note: The first USB device to draw more than 900 mA is allotted up to 1100 mA, while all subsequent devices are limited to 900 mA. Verify USB device operates as expected.</p> <p>Does "Extra Operating Current" appear in System Information?</p>	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
		No	Replace logic board. Verify issue resolved.	M38	MLB

	Check	Result	Action	Code	Commodity
10.	<p>Try user's USB device with a known-good computer. Verify whether it functions normally and is recognized in System Information > USB device tree.</p> <p>Is user's USB device functional and recognized?</p>	Yes	Issue resolved by testing USB ports and verifying user's USB device. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	<p>Advise user to do the following:</p> <ul style="list-style-type: none"> • Contact USB device manufacturer for support. • Verify system requirements and Mac compatibility. • Find out whether device requires additional software. 	\$(nodeText.noSymptomCode)	
11.	<p>Confirm that a known-good USB device is functional and recognized.</p> <p>Check System Information for correct power allocation to USB device.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

USB-C and Thunderbolt Connectivity Issues

Unlikely causes:

Battery, camera, camera cable, fan, DisplayPort cable, hard disk drive (HDD), HDD combo cable, display panel, left speaker, memory, power supply, right speaker, flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"> Standard USB-C devices are not recognized or not powered when connected to computer's USB-C port(s). USB 2 or USB 3 devices are not recognized or not powered when connected to computer's USB-C port(s). External DisplayPort or Thunderbolt devices or displays are not recognized when connected to computer's USB-C port(s). <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"> Verify that any USB hubs connected to the computer have sufficient power for a connected USB device. Check whether the user's USB device requires a specific driver to function properly. If the user is using a USB 3 device, review article HT201163: Using USB 3 devices with Mac computers. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac. Reset SMC using the procedure listed for this computer in HT201295: How to reset the System Management Controller (SMC) on your Mac to return computer to a known power-off state. Try to turn on from power-off state. Do not hold in the power button when turning on the computer. You could inadvertently put the computer into DFU mode if you do. Retest for USB-C connectivity issues. Refer to HT201260: How to find the macOS version number on your Mac to check that the system build is correct for this computer model. Using a Wi-Fi network, check for and apply the latest software and firmware updates. Also check for adapter firmware updates by leaving the user's adapter connected to the computer while running software update. If an update is available, update the adapter's firmware before proceeding further, and retest for USB-C connectivity issues. Refer to the following articles to learn more about Thunderbolt connectivity in this computer: <ul style="list-style-type: none"> HT207256: Connect with Thunderbolt 3 on your new MacBook Pro HT204360: Using USB-C and Thunderbolt 3 (USB-C) ports and adapters on your Mac notebook HT204154: About Thunderbolt ports and displays HT206909: Networking two Mac systems directly with a Thunderbolt 3 cable requires Thunderbolt-enabled hosts HT207113: How to daisy-chain USB 2.0 devices to Thunderbolt 3 ports <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> TP833: iMac and Displays: Power Supply Cover Instructions TP820: iMac (27-inch): Safety TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017) refer to articles:</p> <ul style="list-style-type: none"> TP1620: iMac Pro (2017): Power Supply Cover Instructions TP1637: iMac Pro (2017): Safety

	Check	Result	Action	Code	Commodity
1.	<p>Inspect all USB-C receptacles and rear enclosure openings on the user's computer for any signs of deformation, damage, or debris that may be blocking the connection. Use compressed air to clear any obstructions or debris.</p> <p>Important: Do not use any metal objects to clear debris or obstructions, as this can short the connector and cause damage.</p> <p>Is any USB-C port damaged?</p>	Yes	Go to step 2.	\$(nodeText.yesSymptomCode}	
		No	Go to step 3.	\$(nodeText.noSymptomCode}	
2.	<p>Inspect the opening on the rear enclosure for the USB-C receptacle. Determine whether the opening is misshapen or deformed, preventing proper insertion of the USB-C plugs.</p> <p>Is the opening for the USB-C port damaged or deformed?</p>	Yes	<p>Replace the rear enclosure.</p> <p>Verify that the issue is resolved.</p>	X13	ENCLOSURE
		No	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
3.	<p>Using a known-good Apple USB-C to USB Adapter, connect a known-good high-speed USB (1.1/2.0) device, such as a mouse, keyboard, or USB 2 flash drive to the same USB-C port on the computer.</p> <p>Verify in System Information > USB that the device is detected.</p> <p>Is the USB 1.1/2.0 device detected?</p>	Yes	Go to step 4.	\$(nodeText.yesSymptomCode}	
		No	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M15	MLB
4.	<p>Disconnect and flip the orientation of the USB-C Apple adapter cable plug, then reconnect it to the same USB-C port on the computer and retest, to test both orientations.</p> <p>Refresh the USB Device Tree in System Information by using the Command-R keyboard shortcut, or the File > Refresh Information from the menu bar.</p> <p>Verify in System Information > USB that the device is detected.</p> <p>Is the USB 1.1/2.0 device detected?</p>	Yes	Go to step 5.	\$(nodeText.yesSymptomCode}	
		No	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M15	MLB

	Check	Result	Action	Code	Commodity
5.	Using a known-good Apple USB-C to USB Adapter, connect a known-good USB 3 device, such as a USB 3 hard drive or flash drive to the same USB-C port on the computer. Verify in System Information > USB that the device is detected. Is the USB 3 device detected?	Yes	Go to step 6.	\$(nodeText.yesSymptomCode}	
		No	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M15	MLB
6.	Disconnect and flip the orientation of the USB-C Apple adapter cable plug, then reconnect it to the same USB-C port on the computer and retest, to test both orientations. Refresh the USB Device Tree in System Information by using the Command-R keyboard shortcut, or the File > Refresh Information from the menu bar. Verify in System Information > USB that the device is detected. Is the USB 3 device detected?	Yes	Go to step 7.	\$(nodeText.yesSymptomCode}	
		No	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M15	MLB
7.	Using the user's Apple USB-C to USB Adapter in place of the known-good adapter, connect a known-good USB 3 device, such as a USB 3 hard drive or flash drive to the same USB-C port on the computer. Refer to HT204360: Using USB-C and Thunderbolt 3 (USB-C) ports and adapters on your Mac notebook for more information about Apple USB-C adapters. Refresh the USB Device Tree in System Information by using the Command-R keyboard shortcut, or the File > Refresh Information from the menu bar. Verify in System Information > USB that the device is detected. Be sure to test both orientations. Is the USB 3 device detected?	Yes	Go to step 8.	\$(nodeText.yesSymptomCode}	
		No	Replace the user's Apple USB-C adapter. If the adapter is made by a third party, advise the user to contact the manufacturer for support. Verify that the issue is resolved.	X03	EXTERNAL CABLE

	Check	Result	Action	Code	Commodity
8.	<p>Using a known-good Apple Thunderbolt 3 (USB-C) to Thunderbolt 2 Adapter, connect a known-good external Thunderbolt 2 device such as a display or external disk to the same USB-C port on the computer.</p> <p>Verify in System Information > Thunderbolt that the device is detected.</p> <p>Refer to HT207266: Connect devices and displays with the Apple Thunderbolt 3 (USB-C) to Thunderbolt 2 Adapter for more information about this adapter.</p> <p>Is the Thunderbolt 2 device detected?</p>	Yes	Go to step 9.	\$(nodeText.yesSymptomCode}	
		No	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M33	MLB
9.	<p>Disconnect and flip the orientation of the USB-C Apple adapter cable plug, then reconnect it to the same USB-C port on the computer and retest, to test both orientations.</p> <p>Refresh the USB Device Tree in System Information by using the Command-R keyboard shortcut, or the File > Refresh Information from the menu bar.</p> <p>Verify in System Information > Thunderbolt that the device is detected.</p> <p>Is the Thunderbolt 2 device detected?</p>	Yes	Go to step 10.	\$(nodeText.yesSymptomCode}	
		No	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M33	MLB

	Check	Result	Action	Code	Commodity
10.	Using the user's Apple Thunderbolt 3 (USB-C) to Thunderbolt 2 Adapter in place of the known-good adapter, connect a known-good external Thunderbolt 2 device such as a display or external disk to the same USB-C port on the computer.	Yes	Go to "No Video on External Display" troubleshooting flow.	\$(nodeText.yesSymptomCode)	
	<p>Refer to HT204360: Using USB-C and Thunderbolt 3 (USB-C) ports and adapters on your Mac notebook for more information about Apple USB-C adapters.</p> <p>Refresh the USB Device Tree in System Information by using the Command-R keyboard shortcut, or the File > Refresh Information from the menu bar.</p> <p>Verify in System Information > Thunderbolt that the device is detected.</p> <p>Be sure to test both orientations.</p> <p>Is the Thunderbolt 2 device detected?</p>	No	<p>Replace the user's Apple USB-C adapter.</p> <p>If the adapter is made by a third party, advise the user to contact the manufacturer for support.</p> <p>Verify that the issue is resolved.</p>	X03	EXTERNAL CABLE
11.	Confirm that known-good USB high-speed and SuperSpeed devices and Thunderbolt devices are functional and recognized when connected to all USB-C ports on the computer, in both orientations.	Yes	The issue is resolved. Verify resolution.	\$(nodeText.yesSymptomCode)	
	<p>Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

External USB ODD Noisy

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<p>Note: Be sure you understand what type of optical drive noise you should be concerned about and what noises you can safely ignore. The following lists help distinguish normal, functional optical drive sounds from noises that may indicate drive malfunction.</p> <p>Typical noises include sounds made during the following activities:</p> <ul style="list-style-type: none">• Waking computer from sleep• Burning a CD or DVD• Inserting a disc• Ejecting a disc• Importing (“ripping”) an audio CD in iTunes• Playing a DVD• Accessing an idle disc <p>Abnormal noises include the following:</p> <ul style="list-style-type: none">• Grinding• Loud, repeated clicking• Scraping sounds• Constantly seeking or cycling the eject mechanism with no disc inserted <p>Listen closely in a quiet environment for the following:</p> <ul style="list-style-type: none">• Noise during start up• Noise during operation• Noise when drive is copying or saving data <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Verify that the user’s issue involves only abnormal sounds, as defined in symptoms.2. Make sure the Apple USB SuperDrive is sitting flat on a surface with the silver top facing upward. Do not attempt to operate the SuperDrive on its side or upside-down.3. Verify that there is not an additional label adhered to the disc which could cause the disc to lose balance and create excessive noise when rotating at high speed.4. Verify that the optical drive is actually an Apple USB SuperDrive, which has a longer USB cable (340 mm), and not a MacBook Air SuperDrive, which has a slightly shorter cable (250 mm) that may not reach iMac’s USB ports while sitting on a flat surface alongside iMac.5. Compare optical drive noise to a known-good equivalent Apple USB SuperDrive.6. Verify that the noise issue does not involve waking the computer. When starting up or waking from sleep, the Apple USB SuperDrive may make unfamiliar noises.7. Test the user’s optical disc in a known-good drive to rule out a media issue. Verify disc size and shape are within specification in article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.8. Test Apple USB SuperDrive with known-good discs. Verify media is free to spin without scraping edge or surface of media.9. Verify noise during seek activity is excessive. Seek noise should subside once disc is mounted.10. Verify disc spin noise is excessive. Disc spin should cease 30 seconds after mounting disc in Finder.11. Inspect the Apple USB SuperDrive drive slot for obstructions such as debris or a stuck disc.12. Inspect the Apple USB SuperDrive USB cable and USB connector for damage.13. The Apple USB SuperDrive is designed exclusively for use with iMac, MacBook Pro (Retina, Mid 2012 or later), MacBook Air, and Mac mini (Early 2009 or later). USB ports on other computers may not provide sufficient power to enable proper operation of drive. Verify user’s configuration is supported.14. The Apple USB SuperDrive must be plugged directly into computer’s USB port, and cannot be used while connected to a USB hub.15. Leave the Apple USB SuperDrive connected to the user’s computer and restart the computer while pressing the mouse button or keyboard Eject key to cycle the optical drive.16. If the user is experiencing an issue using the Apple USB SuperDrive with Microsoft Windows, try starting the computer with the Apple USB SuperDrive already plugged in.17. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Check whether the Apple USB SuperDrive is constantly seeking or cycling eject mechanism with no optical disc inserted. Optical drive should perform only one reset sequence and then rest idly, ready for media. Does the optical drive spin, seek, and/or reset continuously without an optical disc inserted?	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J04	OPTICAL
		No	Go to step 2.	\$(nodeText.noSymptomCode)	
2.	Closely inspect the user's Apple USB SuperDrive to determine whether a disc or other debris is stuck inside. Is a disc or other debris stuck in drive?	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
3.	Refer to RP451: Apple USB SuperDrive to open the drive enclosure and remove any stuck disc, dust, debris, or other foreign materials. Retest the Apple USB SuperDrive by inserting, mounting, and ejecting a known-good optical disc. Is optical drive function fully restored?	Yes	Issue resolved by removing stuck disc or debris from drive. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J05	OPTICAL
4.	Insert a known-good optical disc, then eject the disc. Listen carefully to Apple USB SuperDrive disc handling. Eject noise should consist of a pop as disc is released from motor hub, then gear movement as motor pushes disc out of slot. Repeat test several times. Is disc eject noise abnormal and excessive over multiple trials?	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J04	OPTICAL
		No	Go to step 5.	\$(nodeText.noSymptomCode)	
5.	Disconnect the Apple USB SuperDrive and retest for computer noise. Has the noise been eliminated?	Yes	Go to step 6.	\$(nodeText.yesSymptomCode)	
		No	Go to "Noise/Hum/Vibration" troubleshooting flow.	\$(nodeText.noSymptomCode)	
6.	To troubleshoot this issue completely, you will need an identical, known-good Apple USB SuperDrive with which to compare optical drive sounds. Do you have immediate access to a known-good Apple USB SuperDrive?	Yes	Go to step 7.	\$(nodeText.yesSymptomCode)	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J04	OPTICAL

	Check	Result	Action	Code	Commodity
7.	Substitute a known-good Apple USB SuperDrive and retest.	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J04	OPTICAL
	Has the noise been eliminated?	No	Go to “Noise/Hum/Vibration” troubleshooting flow.	\${nodeText.noSymptomCode}	
8.	Verify that the Apple USB SuperDrive does not make any abnormal noises.	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
	Is the issue resolved?	No	Go to “Noise/Hum/Vibration” troubleshooting flow.	\${nodeText.noSymptomCode}	

External USB ODD Not Recognized

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Discs cannot be inserted.• Discs can be inserted, but are ejected immediately.• Discs can be inserted, but are ejected after drive has spun up for a few seconds.• Discs can be inserted and ejected, but do not appear in Finder. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Go to Finder Preferences > General and make sure “CDs, DVDs, and iPods” is checked under “Show these items on the desktop.”2. Make sure the Apple USB SuperDrive is sitting flat on a surface with the silver top facing upward. Do not attempt to operate the SuperDrive on its side or upside-down.3. Verify that the optical drive is actually an Apple USB SuperDrive, which has a longer USB cable (340 mm), and not a MacBook Air SuperDrive, which has a slightly shorter cable (250 mm) that may not reach iMac’s USB ports while sitting on a flat surface alongside iMac.4. Inspect the Apple USB SuperDrive drive slot for obstructions (stuck disc, for example)5. Inspect the Apple USB SuperDrive USB cable and USB connector for damage.6. The Apple USB SuperDrive is designed exclusively for use with iMac, MacBook Pro (Retina, Mid 2012 or later), MacBook Air, and Mac mini (Early 2009 or later). USB ports on other computers may not provide sufficient power to enable proper operation of drive. Verify user’s configuration is supported.7. The Apple USB SuperDrive must be plugged directly into the computer’s USB port, and cannot be used while connected to a USB hub.8. Leave the Apple USB SuperDrive connected to the user’s computer and restart the computer while pressing the mouse button or keyboard Eject key to cycle the optical drive.9. If the user is experiencing an issue using the Apple USB SuperDrive with Microsoft Windows, try starting the computer with the Apple USB SuperDrive already plugged in.10. Refer to article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.11. Connect the user’s Apple USB SuperDrive to a known-good iMac, MacBook Pro (Retina, Mid 2012 or later), MacBook Air, or Mac mini (Early 2009 or later) to verify drive’s functionality separately from user’s computer.12. Disconnect the user’s Apple USB SuperDrive and connect a known-good Apple USB SuperDrive to the same USB port on the user’s computer to verify the computer’s functionality separately from the user’s drive. If the issue persists, troubleshoot as a faulty USB port on the user’s computer.13. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Connect the user's Apple USB SuperDrive to an available USB port on user's computer and start up the computer. Check System Information > Hardware > USB device tree to verify the presence of the optical drive.</p> <p>Repeat this process using each USB port on the user's computer to verify all of the computer's USB ports are functioning.</p> <p>Does drive appear in System Information when connected to every USB port?</p>	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
		No	Go to "USB Port Not Recognized" troubleshooting flow.	`\${nodeText.noSymptomCode}`	
2.	<p>Attempt to insert a known-good, properly formatted CD or DVD disc into the Apple USB SuperDrive. Check whether the disc auto-ejects either immediately or within a few seconds after the drive has spun up.</p> <p>Does disc auto-eject shortly after insertion?</p>	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J01	OPTICAL
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	
3.	<p>After insertion, verify that the disc spins and the disc volume mounts in the Finder.</p> <p>Does drive mount known-good disc?</p>	Yes	Go to step 4.	`\${nodeText.yesSymptomCode}`	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J09	OPTICAL
4.	<p>Check to see whether the Apple USB SuperDrive properly mounts and reads both known-good CD and DVD media.</p> <p>If only one type of media is recognized, there may be a laser issue.</p> <p>Can drive read both media types?</p>	Yes	Issue resolved.	`\${nodeText.yesSymptomCode}`	
		No	Go to "External USB ODD Read/Write or Performance Issues" troubleshooting flow.	`\${nodeText.noSymptomCode}`	
5.	<p>Insert, mount, and eject both a known-good CD and DVD.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	`\${nodeText.yesSymptomCode}`	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	J99	

External USB ODD Read/Write or Performance Issues

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Errors when writing to optical media• Errors when reading from optical media• Hangs when accessing or writing data• Read or write speeds slower than expected <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Test the user's optical disc in a known-good drive to rule out a media issue. Verify disc size and shape are within specification in article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.2. Test known-good, compatible optical media in user's Apple USB SuperDrive connected to a known-good computer.3. Go to System Information > Hardware > Disc Burning to compare actual disc burning specifications to user's expectations.4. See articles HT2543: About optical disc drive burning and write speeds and HT2882: Factors that affect writing to or reading from optical media to learn more about disc burning and how performance is affected by write speeds, media types, software, and more.5. Make sure the Apple USB SuperDrive is sitting flat on a surface with the silver top facing upward. Do not attempt to operate the SuperDrive on its side or upside-down.6. Verify that the optical drive is actually an Apple USB SuperDrive, which has a longer USB cable (340 mm), and not a MacBook Air SuperDrive, which has a slightly shorter cable (250 mm) that may not reach iMac's USB ports while sitting on a flat surface alongside iMac.7. Inspect the Apple USB SuperDrive drive slot for obstructions (stuck disc, for example).8. Inspect the Apple USB SuperDrive USB cable and USB connector for damage.9. The Apple USB SuperDrive is designed exclusively for use with iMac, MacBook Pro (Retina, Mid 2012 or later), MacBook Air, and Mac mini (Early 2009 or later). USB ports on other computers may not provide sufficient power to enable proper drive operation. Verify user's configuration is supported.10. The Apple USB SuperDrive must be directly plugged into the computer's USB port and cannot be used while connected to a USB hub.11. With the Apple USB SuperDrive connected to the user's computer, restart the computer while pressing the mouse button or Eject key to cycle the optical drive.12. If the user is experiencing an issue using the Apple USB SuperDrive with Microsoft Windows, try starting the computer with the Apple USB SuperDrive already plugged in.13. Refer to article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.14. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Connect the user's Apple USB SuperDrive to an available USB port on the user's computer and start up the computer. Insert media into the Apple USB SuperDrive and listen for scraping/scratching noises as the disc spins up. Eject the disc and examine its surface and edges for scrapes or scratches. Verify that the disc can spin without the optical drive scraping the edge or surface of the media. Does media spin freely in the drive?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode}	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J05	OPTICAL
2.	Closely inspect the user's Apple USB SuperDrive to determine if a disc or other debris is stuck inside. Is a disc or other debris stuck in the drive?	Yes	Go to step 3.	\$(nodeText.yesSymptomCode}	
		No	Go to step 4.	\$(nodeText.noSymptomCode}	
3.	Refer to RP451: Apple USB SuperDrive to open the drive enclosure and remove any stuck disc, dust, debris, or other foreign materials. Retest the Apple USB SuperDrive by inserting, mounting, and ejecting a known-good optical disc. Is optical drive function fully restored?	Yes	Issue resolved by removing stuck disc or debris from drive. Verify resolution.	\$(nodeText.yesSymptomCode}	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J05	OPTICAL
4.	Verify that the optical drive can properly read known-good CDs. Can the optical drive read CDs?	Yes	Go to step 5.	\$(nodeText.yesSymptomCode}	
		No	Go to step 6.	\$(nodeText.noSymptomCode}	
5.	Verify that the optical drive can properly read known-good DVDs. Can the optical drive read DVDs?	Yes	Go to step 7.	\$(nodeText.yesSymptomCode}	
		No	Go to step 6.	\$(nodeText.noSymptomCode}	
6.	Check System Information > Hardware > USB to verify presence of optical drive. Does the optical drive appear in System Information?	Yes	Go to step 7.	\$(nodeText.yesSymptomCode}	
		No	Go to "External USB ODD Not Recognized" troubleshooting flow.	\$(nodeText.noSymptomCode}	
7.	Burn test data to CD and DVD media compatible with the Apple USB SuperDrive. Verify that the burned media is recognized and readable by the drive. Can the optical drive read its own burned media?	Yes	Go to step 8.	\$(nodeText.yesSymptomCode}	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J03	OPTICAL

	Check	Result	Action	Code	Commodity
8.	To troubleshoot this issue completely, you will need an identical, known-good Apple USB SuperDrive with which to compare optical disc read and burn times. Do you have immediate access to a known-good Apple USB SuperDrive?	Yes	Go to step 9.	\$(nodeText.yesSymptomCode)	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J07	OPTICAL
9.	Using the same media type and brand, compare read and burn times of the user's Apple USB SuperDrive connected to a known-good computer, against a known-good Apple USB SuperDrive connected to the same computer. Does the user's drive have significantly longer read or burn times than a known-good drive?	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J07	OPTICAL
		No	Issue resolved.	\$(nodeText.noSymptomCode)	
10.	Test all Apple USB SuperDrive functions and drive performance to verify a successful repair. Is the issue resolved?	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	J99	

External USB ODD Rejects, Does Not Accept, or Does Not Eject Media

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Cannot insert a disc into drive.• Cannot eject a disc from drive.• Drive ejects discs immediately after insertion. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Test the user's optical disc in a known-good drive to rule out a media issue. Verify disc size and shape are within specification in article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.2. Connect the user's Apple USB SuperDrive to a known-good iMac, MacBook Pro (Retina, Mid 2012 or later), MacBook Air, or Mac mini (Early 2009 or later) to verify drive's functionality separately from user's computer.3. Disconnect the user's Apple USB SuperDrive and connect a known-good Apple USB SuperDrive to the same USB port on the user's computer to verify the computer's functionality separately from the user's drive. If the issue persists, troubleshoot as a faulty USB port on the user's computer.4. Make sure the Apple USB SuperDrive is sitting flat on a surface with the silver top facing upward. Do not attempt to operate the SuperDrive on its side or upside-down.5. Verify that optical drive is actually an Apple USB SuperDrive, which has a longer USB cable, and not a MacBook Air SuperDrive, which has a slightly shorter cable that may not reach iMac's USB ports while sitting on a flat surface alongside the computer.6. Inspect the Apple USB SuperDrive drive slot for obstructions (stuck disc, for example).7. Inspect the Apple USB SuperDrive USB cable and USB connector for damage.8. The Apple USB SuperDrive is designed exclusively for use with iMac, MacBook Pro (Retina, Mid 2012 or later), MacBook Air, and Mac mini (Early 2009 or later). USB ports on other computers may not provide sufficient power to enable proper operation of drive. Verify user's configuration is supported.9. The Apple USB SuperDrive must be plugged directly into the computer's USB port, and cannot be used while connected to a USB hub.10. Leave the Apple USB SuperDrive connected to the user's computer and restart the computer while pressing the mouse button or keyboard Eject key to cycle the optical drive.11. If the user is experiencing an issue using the Apple USB SuperDrive with Microsoft Windows, try starting the computer with the Apple USB SuperDrive already plugged in.12. Refer to article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.13. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Connect the user's Apple USB SuperDrive to an available USB port on the user's computer and start up the computer. Check System Information > Hardware > USB to verify presence of optical drive. Does the optical drive appear in System Information?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to "External USB ODD Not Recognized" troubleshooting flow.	\$(nodeText.noSymptomCode)	
2.	Closely inspect the user's Apple USB SuperDrive to determine if a disc or other debris is stuck inside. Is a disc or other debris stuck in drive?	Yes	Go to step 13.	\$(nodeText.yesSymptomCode)	
		No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	Verify known-good disc can fit through enclosure slot. Is clearance in enclosure slot sufficient for disc insertion?	Yes	Go to step 5.	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	Closely inspect entire Apple USB SuperDrive enclosure for dents, scratches, or other indications of impact or abuse. Is insufficient clearance due to accidental damage?	Yes	Go to step 14.	\$(nodeText.yesSymptomCode)	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J01	OPTICAL
5.	Inspect the slot on the optical drive assembly for proper disc clearance. Is clearance in optical drive slot sufficient for disc insertion?	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
		No	Go to step 6.	\$(nodeText.noSymptomCode)	
6.	When a CD or DVD pops off the spindle inside an optical drive (usually due to impact to the drive) and remains in the drive mechanism, the loose disc prevents the slot from being able to open fully, creating a "closed condition." Inspect the slot in the optical drive to determine if it is "closed" (not accepting discs). If the disc slot is closed, inspect the drive mechanism, especially the drive enclosure, for evidence of drop damage. Note: If the disc slot is closed, but there is no sign of accidental damage, choose "No" to the question below. Is disc slot access closed due to accidental damage?	Yes	Go to step 14.	\$(nodeText.yesSymptomCode)	
		No	Go to step 7.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
7.	Inspect the slot in the Apple USB SuperDrive to determine if it is “closed” (not accepting discs) because of a stuck disc. Is disc slot access closed because of a stuck disc?	Yes	Go to step 13.	\$(nodeText.yesSymptomCode)	
		No	Go to step 8.	\$(nodeText.noSymptomCode)	
8.	Make sure the optical drive assembly is mounted into the enclosure correctly and is properly aligned with the enclosure slot opening. Is the drive assembly properly aligned with the enclosure slot opening?	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
		No	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	Refer to RP451: Apple USB SuperDrive to open the drive enclosure and align the optical drive assembly with the enclosure’s bezel slot. Retest the Apple USB SuperDrive by inserting, mounting and ejecting a known-good optical disc. Is optical drive function fully restored?	Yes	Issue resolved. Apple USB SuperDrive alignment realigned disc inject function. Verify issue resolved.	\$(nodeText.yesSymptomCode)	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J01	OPTICAL
10.	Attempt to insert a known-good, properly formatted CD or DVD disc into the Apple USB SuperDrive. Check whether the disc auto-ejects either immediately or within a few seconds after the drive has spun up. Does the disc immediately auto-eject?	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J01	OPTICAL
		No	Go to step 11.	\$(nodeText.noSymptomCode)	
11.	After insertion, verify that the disc spins and the disc volume mounts in the Finder. Does the disc volume mount?	Yes	Go to step 12.	\$(nodeText.yesSymptomCode)	
		No	Go to “External USB ODD Read/Write or Performance Issues” troubleshooting flow.	\$(nodeText.noSymptomCode)	
12.	Eject the disc by dragging the disc icon to Trash or selecting the disc icon and pressing the Eject key or Command-E on the keyboard. Does the disc eject properly?	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J02	OPTICAL

	Check	Result	Action	Code	Commodity
13.	Refer to RP451: Apple USB SuperDrive to open the drive enclosure and remove any stuck disc, dust, debris, or other foreign materials.	Yes	Issue resolved by removing stuck disc or debris from drive. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Retest the Apple USB SuperDrive by inserting, mounting, and ejecting a known-good optical disc. Is optical drive function fully restored?	No	Go to step 14.	\$(nodeText.noSymptomCode)	
14.	Inform user that computer failures due to accidental damage are not covered under any Apple warranty, including AppleCare. If applicable, discuss out-of-warranty repair options.	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J05	OPTICAL
	Does user want to proceed with out-of-warranty repair?	No	Issue resolved. Using proper positioning, return the drive to the user.	\$(nodeText.noSymptomCode)	
15.	Insert, mount, and eject a known-good optical disc. Is the issue resolved?	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	J99	

Flash Storage Not Recognized / Not Mounting / Read/Write Issues

Unlikely causes:

Battery, camera, camera/microphone/ALS cable, fan, DisplayPort cable, display panel, left speaker, memory, power supply, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antenna(s)

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Displays flashing folder with question mark or prohibitive symbolCannot save documentsDisplays read/write error message(s)Hangs when accessing or saving dataDrive or volume is not recognized in Disk Utility (icon is grayed out).Cannot erase volume, and bootable drive is not shown in Disk Utility. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>Important: Always ask if the user's data has been backed up before beginning the repair.</p> <ol style="list-style-type: none">1. Disconnect all peripherals and attempt to start up the computer.2. To restore the default startup disk, reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.3. Reset SMC using the procedure listed for this computer in HT201295: How to reset the System Management Controller (SMC) on your Mac to return computer to a known power-off state. Try to turn on from power-off state. Do not hold in the power button when turning on the computer. You could inadvertently put the computer into DFU mode if you do. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP1620: iMac Pro (2017): Power Supply Cover Instructions• TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Connect a known-good Apple wired keyboard and Apple wired mouse to user's computer.	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
	<p>Press the power button to start up the computer.</p> <p>Confirm that computer completes the startup process: Apple logo > progress indicator > login screen > desktop or installer screen.</p> <p>During startup, allow up to four minutes for a defective flash storage to time out, after which the computer will start up from a known-good external device.</p> <p>Does the computer start up completely?</p>	No	Go to the “Will Not Start Up” troubleshooting flow.	\$(nodeText.noSymptomCode)	
2.	Run AST 2 Storage Diagnostic on the user's computer and examine the results of the test.	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	H99	
	Do all internal drive tests pass in Storage Diagnostic?	No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	Examine Storage Diagnostic results for presence of an internal drive.	Pass	Go to step 4.	\$(nodeText.yesSymptomCode)	
	Did drive presence test PASS or FAIL?	Fail	Go to step 12.	\$(nodeText.noSymptomCode)	
4.	Examine Storage Diagnostic results for SMART status.	Pass	Go to step 5.	\$(nodeText.yesSymptomCode)	
	Did SMART test PASS or FAIL?	Fail	Go to step 12.	\$(nodeText.noSymptomCode)	
5.	Examine Storage Diagnostic results for Short Random Multi-Block Read Test.	Pass	Go to step 6.	\$(nodeText.yesSymptomCode)	
	Did Short Random Multi-Block Read Test PASS or FAIL?	Fail	Go to step 12.	\$(nodeText.noSymptomCode)	
6.	Examine Storage Diagnostic results for File System Check.	Pass	Go to step 7.	\$(nodeText.yesSymptomCode)	
	Did File System Check PASS or FAIL?	Fail	Go to step 9.	\$(nodeText.noSymptomCode)	
7.	Examine Storage Diagnostic results for Bootable Volume Presence Check.	Pass	Go to step 8.	\$(nodeText.yesSymptomCode)	
	Did Bootable Volume Check PASS or FAIL?	Fail	Go to step 9.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
8.	Examine Storage Diagnostic results for Last OS Reinstall Check.	Pass	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	H99	
	Did Last OS Reinstall Check PASS or FAIL?	Fail	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	Hold down Command-R during startup to restart from the recovery partition. Use Disk Utility to repair the user's internal flash storage volume.	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
	Attempt to start up from the user's internal flash storage. Does the computer start up successfully from the user's internal flash storage?	No	Go to step 11.	\$(nodeText.noSymptomCode)	
10.	Run AST Storage Diagnostic on the user's computer again and examine the results of the test.	Yes	The issue is resolved by repairing the volume using Disk Utility. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Do all internal drive tests pass in Storage Diagnostic?	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	H99	

	Check	Result	Action	Code	Commodity
11.	Hold down Command-R during startup to restart from the recovery partition. Run Disk Utility and select the user's flash storage drive.	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
	<p>Erase the flash storage drive using Mac OS Extended (Case-sensitive, Journaled) format, and GUID Partition Map scheme.</p> <p>Erase the flash storage drive again using Mac OS Extended (Journaled) format, and GUID Partition Map scheme.</p>	No	Go to step 12.	\$(nodeText.noSymptomCode)	
	<p>Formatting the drive twice with different partition map schemes will force a rewrite of the partitions table.</p> <p>Restore the correct version of macOS on the computer. Use Internet Recovery or a valid build of macOS for this computer, as per article HT201260: How to find the macOS version number on your Mac.</p> <p>Does the computer start up successfully from the user's internal flash storage?</p>				
12.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Go to step 13.	\$(nodeText.yesSymptomCode)	
	<p>Remove display panel and logic board to gain access to flash storage cards.</p> <p>Disconnect and remove both flash storage cards from the logic board.</p> <p>Note from which connector (left or right) that each flash storage card was removed. The cards must be reinstalled into the same connectors from which they were removed, or the computer will not start up. Do not mix up the flash storage cards.</p> <p>Look for damage on logic board connector and flash storage.</p> <p>Look for connector pin damage and missing or bent pins on logic board connector that could prevent correct seating.</p> <p>Did you find damage to flash storage or logic board connectors?</p>	No	Go to step 14.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
13.	Damage to multiple parts requires an escalation to ACS for repair approval. Is damage limited to flash storage?	Yes	Replace flash storage. Verify that the issue is resolved.	H04	SSD
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	H99	
14.	Reconnect user's flash storage. Verify that the flash storage cards are properly seated to the logic board connector. Note: Flash storage in this model is in two matched parts, and must be installed properly or the computer will not start up. Refer to service documentation for more information. Run AST Storage Diagnostic on the user's computer again and examine the results of the test. Do all internal drive tests pass in Storage Diagnostic?	Yes	Issue resolved by reseating flash storage. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 15.	`\${nodeText.noSymptomCode}`	
15.	To troubleshoot this issue completely, known-good bootable flash storage is required. Do you have immediate access to known-good flash storage?	Yes	Go to step 16.	`\${nodeText.yesSymptomCode}`	
		No	Replace flash storage. Verify that the issue is resolved.	H01	SSD
16.	Substitute known-good flash storage. Run AST Storage Diagnostic on the user's computer again and examine the results of the test. Do all internal drive tests pass in Storage Diagnostic?	Yes	Replace flash storage. Verify that the issue is resolved.	H01	SSD
		No	Replace flash storage. Verify that the issue is resolved.	M19	MLB

	Check	Result	Action	Code	Commodity
17.	Confirm that the computer can successfully start up from internal flash storage.	Yes	The issue is resolved. Verify resolution.	`\${nodeText.yesSymptomCode}`	
	<p>Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	H99	

SD Memory Card Cannot Be Inserted Into Slot

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, fan, DisplayPort cable, hard disk drive (HDD), HDD data or power or combo cable, display panel, left speaker, memory, power supply, rear enclosure, right speaker, solid-state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Cannot insert SD card into slot.• Can insert SD card only part way into slot.• Card slot does not align with enclosure. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Check that the user's SD card is not warped or damaged, and that the metal contacts are clean, intact and corrosion-free.2. Verify that the SD card is the correct size. Card dimensions should be 32 mm x 24 mm x 2.1 mm. Note: Cards thicker than 2.1 mm are too thick and may damage the card slot if inserted. Thinner cards such as MultiMediaCards (MMC) are acceptable. Refer to article HT204384: About the SD and SDXC card slot on your Mac for further information.3. Verify that the computer's SD card slot is not obstructed in any way. Use a flashlight to look into slot to make sure nothing is already inserted. If so, carefully remove the obstruction from the slot. Try to reinsert the SD card. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none">• TP1620: iMac Pro (2017): Power Supply Cover Instructions• TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Insert known-good, formatted SD card into user's computer. Verify that it seats correctly.</p> <p>Does known-good SD card seat correctly when inserted?</p>	Yes	Issue resolved. Defective or incompatible SD card. Advise user to contact SD card vendor for support. Refer them to article HT204384: About the SD and SDXC card slot on your Mac for further information.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 2.	`\${nodeText.noSymptomCode}`	
2.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Remove chin strap to avoid bending or damaging it while aligning logic board.</p> <p>Loosen but do not remove all logic board screws. You should be able to shift board position slightly, both left to right and up and down. Take care to avoid damaging cabling or other components while moving logic board.</p> <p>Insert known-good SD card again.</p> <p>Can you now insert known-good SD card correctly?</p>	Yes	Go to step 3.	`\${nodeText.yesSymptomCode}`	
		No	Replace logic board. Verify issue resolved.	M27	MLB
3.	<p>Hold the logic board in position and tighten all logic board screws. Insert the known-good SD card again.</p> <p>Can you now insert and remove known-good SD card correctly?</p>	Yes	Issue resolved with logic board alignment. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Replace logic board. Verify issue resolved.	M27	MLB
4.	<p>Verify that a known-good SD memory card can be fully inserted into and ejected from slot and that it seats correctly.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	`\${nodeText.yesSymptomCode}`	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

SD Memory Card Not Recognized

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, fan, DisplayPort cable, hard disk drive (HDD), HDD data or power or combo cable, display panel, left speaker, memory, power supply, rear enclosure, right speaker, solid-state drive (SSD) / flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">SD card does not appear on desktop or in System Information. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">Make sure the SD card is unlocked.Check that the user's SD card is not warped or damaged and that the metal contacts are clean, intact, and corrosion free.Verify that the computer's SD card slot is not damaged or obstructed. Use a flashlight to inspect the slot to make sure nothing is already inserted. If so, carefully remove the obstruction from the slot. Try to reinsert the SD card.Verify that the SD card is the correct size. Card dimensions should be 32 mm x 24 mm x 2.1 mm. Note: Cards thicker than 2.1 mm are too thick and may damage card slot if inserted. Thinner cards such as MultiMediaCards (MMC) are acceptable. Refer to article HT204384: About the SD and SDXC card slot on your Mac for further specifications.Consult article HT204384: About the SD and SDXC card slot on your Mac and check for compatible SD card type and format.<ul style="list-style-type: none">SD card slot can accommodate cards that are Standard SD (Secure Digital) 4MB to 2GB, SDHC (Secure Digital High Capacity) 4GB to 32GB, and SDXC (Secure Digital Extended Capacity) 4GB to 2TB. MMC cards can also be used in this slot.While SDIO (Secure Digital Input Output) cards fit into and should not damage the card slot, they are not supported.MiniSD and Micro SD cards require adapters.For a more specific SD card type or format (wireless-enabled SD card or other SD card for example), make sure the correct driver is installed. macOS supports only standard SD memory cards; other cards may require specific driver software.Make sure Finder Preferences > General is set to show External Disks.Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Insert a known-good, formatted SD card into user's computer. Verify that card seats correctly. Does known-good SD card seat correctly when inserted?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to "SD Memory Card Cannot Be Inserted Into Slot" troubleshooting flow.	\$(nodeText.noSymptomCode)	
2.	Verify that a known-good SD card appears in Disk Utility and mounts in Finder. Verify that computer can read data from and write data to card. Can computer read from and write to known-good SD card?	Yes	Go to step 5.	\$(nodeText.yesSymptomCode)	
		No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	Start up user's computer with restore partition or up-to-date, bootable macOS volume. Refer to HT204319: Use the Mac operating system that came with your Mac, or a compatible newer version to make sure system build is correct for this computer model. Verify that a known-good SD card appears and mounts in Disk Utility and Finder. Can computer now read from and write to known-good SD card?	Yes	Repair permissions and directory using Disk Utility. If issue persists, restore macOS (with correct system build). Retest to verify resolution. Check that user has necessary driver software.	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	Check System Information to verify that SD card reader is listed in USB devices. Does SD card reader appear in System Information?	Yes	Go to step 5.	\$(nodeText.yesSymptomCode)	
		No	Replace logic board, which includes SD card reader. Verify issue resolved.	M27	MLB
5.	Insert user's SD card into user's computer. Verify that it seats correctly. Does user's SD card seat correctly when inserted?	Yes	Go to step 6.	\$(nodeText.yesSymptomCode)	
		No	Defective or incompatible SD card. Advise user to contact SD card manufacturer for support. Refer user to article HT204384: About the SD and SDXC card slot on your Mac for further information.	\$(nodeText.noSymptomCode)	
6.	Verify that SD card appears in left column of Disk Utility. If card does not appear, eject and reinsert card. If inserted too slowly, card may not appear. Does SD card appear in Disk Utility?	Yes	Go to step 8.	\$(nodeText.yesSymptomCode)	
		No	Go to step 7.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
7.	Insert user's SD card into a known-good computer. Verify that computer can read data from and write data to SD card.	Yes	Repair permissions and directory on user's computer using Disk Utility. If issue persists, restore macOS (with correct system build). Retest to verify resolution. Check that user has necessary driver software.	\$(nodeText.yesSymptomCode)	
	Can a known-good computer read from and write to user's SD card?	No	Defective or incompatible SD card. Advise user to contact SD card manufacturer for support. Refer user to article HT204384: About the SD and SDXC card slot on your Mac for further information.	\$(nodeText.noSymptomCode)	
8.	Verify that user's SD card volume appears in Disk Utility and mounts in Finder.	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
	Does card volume mount in Finder or Disk Utility?	No	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	Format user's SD Card as macOS Extended Journaled with a GUID partition scheme.	Yes	Issue resolved by reformatting SD card. Verify resolution.	\$(nodeText.yesSymptomCode)	
	<p>Important: Make sure user has a valid backup first. If formatting is successful, retest SD card by writing data to and retrieving data from card.</p> <p>Were you able to reformat, then write to and read from the card successfully?</p>	No	Defective or incompatible SD card. Advise user to contact SD card manufacturer for support. Refer user to article HT204384: About the SD and SDXC card slot on your Mac for further information.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
10.	<p>Test user's SD card by writing data to and retrieving data from card.</p> <p>Were you able to write to and read from user's card successfully?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Verify issue resolved.</p> <p>If the issue persists, contact ACS for additional support.</p>	M99	
		No	<p>Defective or incompatible SD card. Advise user to contact SD card manufacturer for support. Refer user to article HT204384: About the SD and SDXC card slot on your Mac for further information.</p>	\${nodeText.noSymptomCode}	
11.	<p>Verify that user's computer can successfully read from and write to a known-good SD card.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

Burnt Smell / Odor

Unlikely causes:

Rear enclosure, stand

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Computer emits a burnt, smoky, or other unusual odor <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">Verify that the computer is the source of odor.Disconnect all third-party devices to eliminate external devices as source of odor.Odors can be related to how new the product is. Refer to article HT202324: New equipment: Odors may be present short-term.Determine whether this is a safety issue. Refer to article OP44: Handling Potential Product Safety Issues.Inspect the enclosure and components for obvious signs of burning or smoky residue. Check rear vents, slots, ports, and power cord. Refer to article HT203529: Smoke emitted may be from failed component.Inspect the air intake vents and outlets for any obstructions. Make sure air can flow freely into and out of enclosure.Clean the enclosure to eliminate odors resulting from external contamination. Refer to article HT204172: How to clean your Apple products. Explain the cause to the user.Verify functionality of the computer. If the computer is nonfunctional, troubleshoot that first as a separate issue. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">TP833: iMac and Displays: Power Supply Cover InstructionsTP820: iMac (27-inch): SafetyTP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none">TP1620: iMac Pro (2017): Power Supply Cover InstructionsTP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Closely inspect computer for a possible safety issue.</p> <p>Have you identified any safety issues?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for safety-related issues.</p> <p>Refer to article OP44: Handling Potential Product Safety Issues.</p>	T99	
		No	Go to step 2.	\${nodeText.noSymptomCode}	
2.	<p>Odor can be related to external contamination. Inspect computer exterior for contamination or lack of cleanliness.</p> <p>Can you determine that odor is caused by external contamination?</p>	Yes	Go to step 3.	\${nodeText.yesSymptomCode}	
		No	Go to step 4.	\${nodeText.noSymptomCode}	
3.	<p>Thoroughly clean the entire enclosure and all external surfaces. Refer to article HT204172: How to clean your Apple products. Explain cause to the user.</p> <p>Does user agree that odor is due to external contamination?</p>	Yes	Issue resolved. Verify resolution.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support.</p>	M99	
4.	<p>Odors can be related to how new the product is. Refer to article HT202324: New equipment: Odors may be present short-term.</p> <p>Can you determine that odor is due to newness?</p>	Yes	Go to step 5.	\${nodeText.yesSymptomCode}	
		No	Go to step 6.	\${nodeText.noSymptomCode}	
5.	<p>Explain to user that new computers can sometimes emit an odor similar to odors generated by new carpeting or a new car. In most cases, odor dissipates after a brief period. Refer user to article HT202324: New equipment: Odors may be present short-term.</p> <p>Does user agree odor is related to computer's newness?</p>	Yes	Issue resolved. Verify resolution.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support.</p>	M99	

	Check	Result	Action	Code	Commodity
6.	<p>Inspect each module and its associated cables for signs of burnt or damaged components, smoke residue or other traces of burning, and melted or damaged wiring.</p> <p>Have you identified a component failure as source of odor?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS to troubleshoot burnt or failed components.</p>	M99	
		No	Go to step 7.	\${nodeText.noSymptomCode}	
7.	<p>Closely inspect internal components and enclosure for indications of physical damage or internal contamination.</p> <p>Can you identify signs of internal damage or contamination?</p>	Yes	Go to step 8.	\${nodeText.yesSymptomCode}	
		No	Go to step 9.	\${nodeText.noSymptomCode}	
8.	<p>Inform the user that computer failures due to accidental damage are not covered under any Apple warranty, including AppleCare. If applicable, discuss out-of-warranty repair options.</p> <p>Does user want to proceed with out-of-warranty repair?</p>	Yes	Proceed with out-of-warranty repair. Verify resolution.	\${nodeText.yesSymptomCode}	
		No	Issue resolved. Return computer to user using correct positioning.	\${nodeText.noSymptomCode}	
9.	<p>Run the computer for several hours and monitor for the issue/odor.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>If no functional failure is detected, use correct positioning to explain to the user that the odor is related to external contamination or the computer being new.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

Computer Runs Hot

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, DisplayPort cable, hard drive data or power or combo cable, left speaker, memory, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"> • Computer feels unusually warm. • Fan is not operating. • Fan is not functioning to its full capacity. • Fan runs constantly at high speeds. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"> 1. Run Mac Resource Inspector (MRI) to verify correct operation of sensors and fan. 2. Check for and apply latest software and firmware updates. 3. Inspect fan performance during operation to make sure fan is spinning. Check that vents are not blocked, and if necessary, use compressed air to remove dust or debris from rear fan exhaust. 4. Compare computer's operating temperature to a known-good, similarly configured computer. 5. Check for runaway applications using the information in article HT203184: See how apps affect Mac performance, battery runtime, temperature, and fan activity. Follow the instructions to halt any processes that are using excessive system resources. 6. Processor-intensive/graphics-intensive applications and system processes may cause the enclosure to feel warm. Use Activity Monitor to identify these types of programs and explain issue to user. 7. Reset SMC using the procedure listed for this computer in HT201295: How to reset the System Management Controller (SMC) on your Mac to return computer to a known power-off state. Try to turn on from power-off state. Do not hold in the power button when turning on the computer. You could inadvertently put the computer into DFU mode if you do. 8. Verify that computer's internal hard drive or flash storage is an Apple-installed part. Compare hard drive information in System Information to the Apple Hard Drives Matrix in article SM155: Hard Drives Matrix to determine whether user's installed drive is one of OEM drives available for this computer configuration. Third-party hard drives without correct firmware or thermal sensors, or outside this computer's specifications, may cause computer to run hot or permanently activate fan at full speed. In such cases, inform user that computer has been modified from its original, supported configuration, and that such a repair would not be covered under Apple warranty. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP833: iMac and Displays: Power Supply Cover Instructions • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none"> • TP1620: iMac Pro (2017): Power Supply Cover Instructions • TP1637: iMac Pro (2017): Safety

	Check	Result	Action	Code	Commodity
1.	Run diagnostics or Mac Resource Inspector (MRI) and consult diagnostic logs to check for fan (motor) or sensor failures.	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
	<p>An inoperative or clogged fan can cause the computer to run hot.</p> <p>Sensor(s) that indicate they are out of normal operating range can help isolate why the computer is running hot.</p> <p>Does computer pass all MRI checks?</p>	No	Go to step 8.	`\${nodeText.noSymptomCode}`	
2.	<p>Use extended version of Cooling System Diagnostics (CSD) to verify proper function of the following subsystems:</p> <ul style="list-style-type: none"> • SMC • Fan • Thermal sensors • CPU–heat sink thermal interface <p>Does computer pass all CSD tests?</p>	Yes	Computer passed all CSD tests. Verify operation and refer user to article HT202179: Learn about the fans in your Mac.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	
3.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Remove all fan screws and extract fan to reveal heat sink or fan air duct. Use an ESD-safe vacuum to remove dust or debris from inner side of heat sink fin stack. Clean fan rotor blades. Reinstall fan and reseal fan cable connections to logic board. Reassemble and retest with CSD.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>Does computer pass all CSD checks?</p>	Yes	Issue resolved by cleaning fan and heat sink and reseating fan connections. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 4.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
4.	To troubleshoot this issue completely, a known-good fan is required. Do you have immediate access to known-good fan?	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
		No	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
5.	Substitute a known-good fan and retest using MRI and CSD. Does computer now pass MRI and CSD tests?	Yes	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
		No	Go to step 6.	`\${nodeText.noSymptomCode}`	
6.	To troubleshoot this issue completely, a known-good logic board is required. Do you have immediate access to a known-good logic board?	Yes	Go to step 7.	`\${nodeText.yesSymptomCode}`	
		No	Reinstall user's fan. Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M18	MLB
7.	Continue to use known-good fan. Substitute a known-good logic board. Reassemble computer and retest with MRI. Do both known-good fan and logic board pass MRI and run-in tests?	Yes	Reinstall user's fan. Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M18	MLB
		No	Replace power supply. Verify issue resolved.	P17	POWER SUPPLY
8.	Determine specific type of failure reported in diagnostics: thermal/fan sensor or voltage/current sensor. <ul style="list-style-type: none"> MRI thermal sensors begin with Txxx. MRI electrical voltage sensors begin with Vxxx. MRI electrical current sensors begin with Ixxx. Which sensor failure does diagnostics report?	Voltage/Current Sensor	Go to step 9.	`\${nodeText.yesSymptomCode}`	
		Thermal/Fan Sensor	Go to step 15.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
9.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding. Remove display panel. Some power-related sensors are located in power supply, but are read through a SMBus connection to logic board. Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. Does MRI report a VDxx or IDxx test failure?	Yes	Go to step 10.	`\${nodeText.yesSymptomCode}`	
		No/Other	Go to step 13.	`\${nodeText.noSymptomCode}`	
10.	Reseat DC power cable connection to logic board. Reassemble and retest, using MRI. Does MRI still report a VDxx or IDxx sensor test failure?	Yes	Go to step 11.	`\${nodeText.yesSymptomCode}`	
		No	Issue resolved by reseating DC power cable connection between power supply and logic board. Verify resolution.	`\${nodeText.noSymptomCode}`	
11.	To troubleshoot this issue completely, a known-good power supply is required. Do you have immediate access to a known-good power supply?	Yes	Go to step 12.	`\${nodeText.yesSymptomCode}`	
		No	DC power cable is part of power supply. Replace power supply. Verify that the issue is resolved.	P17	POWER SUPPLY

	Check	Result	Action	Code	Commodity
12.	Substitute a known-good power supply, reassemble and retest using MRI. Does MRI still report a VDxx or IDxx sensor test failure?	Yes	Reinstall user's power supply. Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M18	MLB
		No	DC power cable is part of power supply. Replace power supply. Verify that the issue is resolved.	P17	POWER SUPPLY
13.	Most voltage and current regulators are located on logic board. To troubleshoot this issue completely, a known-good logic board is required. Do you have immediate access to a known-good logic board?	Yes	Go to step 14.	\${nodeText.yesSymptomCode}	
		No	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M18	MLB
14.	Substitute a known-good logic board, reassemble and retest using MRI. Does MRI still report a Vxxx or Ixxx sensor test failure?	Yes	Reinstall user's logic board. Replace power supply. Verify issue resolved.	P17	POWER SUPPLY
		No	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M18	MLB
15.	Identify specific type of failure reported in MRI/diagnostics: thermal sensor or fan (motor) error. MRI thermal sensors begin with Txxx. Which sensor failure does diagnostics report?	Fan (Motor)	Go to step 16.	\${nodeText.yesSymptomCode}	
		Thermal	Go to step 22.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
16.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Refer to the service guide Functional Overview to locate affected fan connection to logic board. Disconnect fan cable connectors and inspect logic board and fan cable connector pins for damage.</p> <p>Is there any cable or connector damage on fan or logic board?</p>	Yes	Go to step 17.	\$_{nodeText.yesSymptomCode}	
		No	Go to step 19.	\$_{nodeText.noSymptomCode}	
17.	<p>Identify whether fan, logic board, or both are damaged.</p> <p>Are both fan and logic board damaged?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	\$_{nodeText.yesSymptomCode}	
		No	Go to step 18.	\$_{nodeText.noSymptomCode}	
18.	<p>Identify whether fan or logic board is damaged.</p> <p>Which part is damaged?</p>	Fan	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
		Logic Board	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M24	MLB

	Check	Result	Action	Code	Commodity
19.	Remove all fan screws and extract fan to reveal heat sink or fan air duct. Use an ESD-safe vacuum to remove dust or debris from inner side of heat sink fin stack. Clean fan rotor blades. Reinstall fan and reseal fan cable connections to logic board. Reassemble and retest with MRI. Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. Does computer pass fan motor check?	Yes	Issue resolved by cleaning fan and heat sink and reseating fan connections. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 20.	`\${nodeText.noSymptomCode}`	
20.	To troubleshoot this issue completely, a known-good fan is required. Do you have immediate access to a known-good fan?	Yes	Go to step 21.	`\${nodeText.yesSymptomCode}`	
		No	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
21.	Substitute a known-good fan, and retest using MRI. Does computer now pass fan motor check?	Yes	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
		No	Reinstall user's fan. Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M08	MLB

	Check	Result	Action	Code	Commodity
22.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Go to step 23.	\${nodeText.yesSymptomCode}	
	Remove display panel. Remove all fan screws and extract fan to reveal heat sink or fan air duct. Use an ESD-safe vacuum to remove dust or debris from inner side of heat sink fin stack. Clean fan rotor blades. Reinstall fan and reseat fan cable connections to logic board. Reassemble and retest with MRI. Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. Does MRI still report a Txxx thermal sensor test failure?	No	Issue resolved by cleaning fan and heat sink and reseating fan connections. Verify resolution.	\${nodeText.noSymptomCode}	
23.	Identify whether a thermal sensor that is currently failing MRI test is related to the logic board. Refer to service documentation for information about thermal sensors. Is a logic board thermal sensor failing a test?	Yes	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M23	MLB
		No	Go to step 24.	\${nodeText.noSymptomCode}	
24.	Identify whether a thermal sensor that is currently failing MRI test is related to the Hard Disk Drive (HDD) or Flash Storage. Note: Some models do not have a HDD.	Yes	Go to step 25.	\${nodeText.yesSymptomCode}	
	Is a hard drive or flash storage thermal sensor failing a test?	No	Go to step 29.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
25.	Verify in article SM155: Hard Drives Matrix that the installed hard drive or flash storage model is compatible with this computer configuration. Is installed HDD or flash storage compatible with this model?	Yes	Go to step 26.	`\${nodeText.yesSymptomCode}`	
		No	Unsupported HDD or Flash Storage installed, or missing/incorrect hard drive thermal sensor. Check with user for out-of-warranty resolution. Verify resolution.	`\${nodeText.noSymptomCode}`	
26.	Identify the type of storage device affected: <ul style="list-style-type: none"> • Hard Disk Drive (HDD) • Flash Storage Is the affected device an HDD or flash storage?	HDD	Go to step 27.	`\${nodeText.yesSymptomCode}`	
		Flash Storage	Replace the user's flash storage. Verify issue resolved.	H85	SSD
27.	To troubleshoot this issue completely, a known-good hard drive data cable or hard drive combo cable (depending on model) is required. Do you have immediate access to a known-good hard drive data cable or hard drive combo cable?	Yes	Go to step 28.	`\${nodeText.yesSymptomCode}`	
		No	Replace the user's hard drive. Verify issue resolved.	H85	HDD
28.	Substitute a known-good hard drive data cable or hard drive combo cable (depending on model) and retest using MRI. Does computer now pass the THxx sensor check?	Yes	Replace the user's hard drive data cable or hard drive combo cable (depending on model). Verify issue resolved.	X03	INTERNAL CABLE
		No	Reinstall user's hard drive data cable or combo cable (depending on model). Replace the user's hard drive. Verify issue resolved.	H85	HDD
29.	Identify whether a thermal sensor that is currently failing MRI test is related to the power supply. Is a power supply thermal sensor failing a test?	Yes	Replace power supply. Verify issue resolved.	P17	POWER SUPPLY
		No	Go to step 30.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
30.	<p>Identify whether a thermal sensor that is currently failing MRI test is related to the display.</p> <p>Is a display thermal sensor failing a test?</p>	Yes	Go to step 31.	`\${nodeText.yesSymptomCode}`	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	
31.	<p>To troubleshoot this issue completely, a known-good display panel is required.</p> <p>Do you have immediate access to a known-good display panel?</p>	Yes	Go to step 32.	`\${nodeText.yesSymptomCode}`	
		No	Replace display panel. Verify issue resolved.	L85	LCD
32.	<p>Substitute a known-good display panel and retest using MRI.</p> <p>Does MRI still report a TL0p or TL1p thermal sensor test failure?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	`\${nodeText.yesSymptomCode}`	
		No	Replace display panel. Verify issue resolved.	L85	LCD
33.	<p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	`\${nodeText.yesSymptomCode}`	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

Mechanical/Physical/Cosmetic Damage

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<p>The computer shows signs of physical and/or cosmetic damage such as:</p> <p>Enclosure and stand:</p> <ul style="list-style-type: none">• Stand hinge is loose or broken.• Stand is bent, loose, or broken.• Screw is stripped, loose, or missing.• Scratches.• Dents.• Cracks.• Liquid spill. <p>Display Assembly:</p> <ul style="list-style-type: none">• Broken glass.• Cracked display panel.• Scratches.• Dents.• Liquid spill. <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>Inspect computer and discuss nature of issue with user. Determine whether user wants to proceed with repair (despite possible accidental damage) or pursue other service options. Click “No” to proceed with further troubleshooting.</p> <p>Note: For input device issues, including damage, go to the “External Apple Bluetooth Peripherals” or “External Apple Wired Keyboard and Mouse” troubleshooting flows.</p>

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Determine cause of damage or defect: user/technician, environment, accidental damage, or abuse.	Yes	ESCALATION REQUIRED. Contact ACS for assistance with Apple-related accidental damage.	X99	
	Is an Apple agent responsible for damage or defect on computer?	No	Go to step 2.	`\${nodeText.noSymptomCode}`	
2.	Closely examine the user's computer for signs of enclosure damage, such as the following: <ul style="list-style-type: none">• Stand hinge is loose or broken.• Screw is stripped, loose, or missing.• Stand is bent, loose, or broken.	Yes	Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP). Refer to www.apple.com/legal/warranty for details.	X12	ENCLOSURE
	Does the computer exhibit this type of damage?	No	Go to step 3.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
3.	<p>Closely examine the user's computer for signs of enclosure damage, such as the following:</p> <ul style="list-style-type: none"> • Scratches • Dents • Cracks <p>Does the computer exhibit this type of damage?</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	X13	ENCLOSURE
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	<p>Closely examine the user's computer enclosure for signs of liquid spill damage.</p> <p>Look for any signs of liquid spill, liquid penetration, or liquid damage to the computer's enclosure.</p> <p>Does the computer exhibit this type of damage?</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	X90	ENCLOSURE
		No	Go to step 5.	\$(nodeText.noSymptomCode)	
5.	<p>Closely examine the user's computer for signs of display damage, such as a cracked, dented, or broken display frame and/or assembly housing.</p> <p>Does the computer exhibit this type of damage?</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	L18	LCD
		No	Go to step 6.	\$(nodeText.noSymptomCode)	
6.	<p>Closely examine the user's computer display panel for signs of cosmetic damage, such as the following:</p> <ul style="list-style-type: none"> • Scratches • Dents <p>Does the computer exhibit this type of damage?</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	L19	LCD
		No	Go to step 7.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
7.	<p>Closely examine the user's computer display panel for signs of a single hairline crack.</p> <p>A single hairline crack is one continuous curved or straight crack. It may travel across the whole screen or cover a small area.</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	L35	LCD
	Does the computer exhibit this type of damage?	No	Go to step 8.	\$(nodeText.noSymptomCode)	
8.	<p>Closely examine the user's computer display panel for signs of multiple cracks.</p> <p>Two or more glass cracks, or two or more hairline cracks, count as multiple cracks.</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	L36	LCD
	Does the computer exhibit this type of damage?	No	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	<p>Closely examine the user's computer display panel for signs of liquid spill damage.</p> <p>Look for any signs of liquid spill, liquid penetration, or liquid damage to the computer's display panel.</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	L90	LCD
	Does the computer exhibit this type of damage?	No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for assistance with Apple-related accidental damage.</p>	\$(nodeText.noSymptomCode)	

Noise/Hum/Vibration

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, DisplayPort cable, hard disk drive (HDD), hard drive data or power or combo cable, display panel, left speaker, logic board, memory, rear enclosure, right speaker, solid-state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Buzzing noise• Rattling noise• Ticking noise• Squeaking noise• Humming noise• High frequency noise• Mechanical vibration <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>Note: Verify the issue after using the computer for a few minutes to warm it, or by following steps in HT207571: Warm a Mac for testing. Doing this may help identify intermittent issues.</p> <ol style="list-style-type: none">1. Work with the user to reproduce the issue and isolate the source of noise. Differentiate whether the noise is coming from the computer or a connected peripheral. Disconnect all third-party peripherals to isolate the source of noise.2. Determine whether the sound is normal or abnormal. Refer to article TS3204: iMac: Evaluating System noises for more information.3. If the iMac fan runs at full speed after the computer turns on, you may need to reset the iMac's SMC. Refer to articles HT204463: iMac: Fans run at full speed after computer turns on and HT202179: About fans and fan noise in your Apple product for more information. Reset SMC using procedure listed for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac.4. Verify that the vents on the bottom and back of the computer are free of dust and other obstructions that might inhibit proper airflow through the computer.5. Launch Applications > Utilities > Activity Monitor. Determine whether an application or process is consuming a high percentage of CPU bandwidth. CPU-intensive applications can cause fan to run fast in order to maintain proper internal computer temperatures. If needed, quit application or restart the computer to resolve issue. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP833: iMac and Displays: Power Supply Cover Instructions• TP820: iMac (27-inch): Safety• TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none">• TP1620: iMac Pro (2017): Power Supply Cover Instructions• TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Disconnect any peripheral devices, cards, or cables attached to computer.	Yes	Issue resolved. Issue caused by ground loop induced by third-party devices. Advise user to connect all devices to a common power outlet or contact device manufacturer for support.	\$(nodeText.yesSymptomCode)	
	Has the noise been eliminated?	No	Go to step 2.	\$(nodeText.noSymptomCode)	
2.	Tilt display to hinge limits to determine whether mechanical noise is generated by hinge mechanism.	Yes	Go to “Stand/Hinge Issues” troubleshooting flow.	\$(nodeText.yesSymptomCode)	
	Is the noise coming from iMac's display hinge?	No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Replace power supply. Verify issue resolved.	P04	POWER SUPPLY
	Remove display panel. Connect computer to AC power and listen carefully around power supply to verify whether it is source of noise. Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. Is noise coming from iMac's power supply?	No	Go to step 4.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
4.	Shut down computer. If you reinstalled display panel, remove it.	Yes	Issue resolved by removing loose objects inside chin area.	\$(nodeText.yesSymptomCode}	
	Hold computer firmly with both hands and invert computer while gently shaking it, to attempt to dislodge and remove any loose screws or other foreign objects that may have fallen down inside the computer into the chin area.				
	Loose objects in the chin area can cause noise or vibration, especially during audio playback.	No	Go to step 5.	\$(nodeText.noSymptomCode}	
	Briefly retest for noise, hum, or vibration.				
5.	Has noise been eliminated?				
	Shut down computer and let it cool off fully. Check for noise, hum or vibration during startup when computer is cold.	Yes	Go to step 6.	\$(nodeText.yesSymptomCode}	
		No	Go to step 12.	\$(nodeText.noSymptomCode}	
	Does issue happen on or after a cold startup?				
6.	An unreadable thermal sensor can cause fan to run excessively. Run Mac Resource Inspector (MRI) to check thermal sensors.	Yes	Go to “Computer Runs Hot” troubleshooting flow.	\$(nodeText.yesSymptomCode}	
		No	Go to step 7.	\$(nodeText.noSymptomCode}	
	Does MRI report any thermal sensor failures?				
7.	Excessive fan operation may also occur if computer is unable to read fan speed. Check MRI results for fan (motor) sensor test results.	Yes	Go to step 8.	\$(nodeText.yesSymptomCode}	
		No	Go to step 10.	\$(nodeText.noSymptomCode}	
	Does MRI report any fan (motor) failures?				
8.	To troubleshoot this issue completely, a known-good fan is required.	Yes	Go to step 9.	\$(nodeText.yesSymptomCode}	
		No	Replace fan. Verify issue resolved.	X23	OTHER ELECTRIC
	Do you have immediate access to known-good fan?				
9.	Substitute known-good fan and retest with MRI.	Yes	Replace fan. Verify issue resolved.	X23	OTHER ELECTRIC
		No	Reinstall user's fan. Replace the logic board. Verify issue resolved.	M23	MLB
	Does known-good fan pass fan (motor) test in MRI?				
10.	Disconnect fan and briefly retest for noise, hum, or vibration.	Yes	Go to step 11.	\$(nodeText.yesSymptomCode}	
		No	Go to step 12.	\$(nodeText.noSymptomCode}	
	Has noise been eliminated?				

	Check	Result	Action	Code	Commodity
11.	Verify whether any tape, gasket, cable label, cable, or other material is touching fan blades and causing a ticking or buzzing noise. Secure material so it does not touch fan blades. If tape adhesive has lost its stickiness, replace that section of tape.	Yes	Issue resolved by securing internal components or material to prevent touching fan blades. Verify resolution.	\$(nodeText.yesSymptomCode}	
	Remove fan and rotate blades. Verify that fan blades spin smoothly without interference from fan housing, cables, tape, gaskets or other components.				
	Reinstall fan while carefully ensuring that there are no cables routed under or near fan assembly that might cause interference with fan blades. After reassembling computer, verify whether noise issue is resolved.	No	Replace fan. Verify issue resolved.	X23	OTHER ELECTRIC
	Has noise been eliminated?				
12.	Depending on configuration, there may or may not be a hard drive installed. Other configurations may have either a flash storage card or both flash storage and HDD.	Yes	Go to step 13.	\$(nodeText.yesSymptomCode}	
		No	Go to step 14.	\$(nodeText.noSymptomCode}	
	Is a hard drive installed in computer?				
13.	Remove internal hard drive and start up computer from recovery partition or an up-to-date, bootable macOS volume.	Yes	Go to “HDD Noisy” troubleshooting flow.	\$(nodeText.yesSymptomCode}	
	Has noise been eliminated?	No	Go to step 14.	\$(nodeText.noSymptomCode}	
14.	Play sound sample at loud and soft volume levels to determine whether noise is caused by left/right speakers or amplifier circuit. Plug in external headphones to identify whether noise comes from audio out or from other source. Mute computer volume. Verify whether issue still occurs.	Yes	Go to “Distorted Audio from Internal Speaker(s)” troubleshooting flow.	\$(nodeText.yesSymptomCode}	
		No	Go to step 15.	\$(nodeText.noSymptomCode}	
	Has noise been eliminated?				
15.	To troubleshoot this issue completely, a known-good fan is required.	Yes	Go to step 16.	\$(nodeText.yesSymptomCode}	
		No	Go to step 17.	\$(nodeText.noSymptomCode}	
	Do you have immediate access to a known-good fan?				
16.	Substitute known-good fan and retest.	Yes	Replace fan. Verify issue resolved.	X23	OTHER ELECTRIC
	Has noise been eliminated?	No	Go to step 18.	\$(nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
17.	Disconnect fan and briefly retest for noise, hum, or vibration.	Yes	Replace fan. Verify issue resolved.	X23	OTHER ELECTRIC
	Has noise been eliminated?	No	Go to step 18.	\$(nodeText.noSymptomCode)	
18.	With hard drive and fan disconnected, briefly retest once again while listening closely for any noise, hum, or vibration coming from logic board and heat sink assembly.	Yes	Replace logic board. Verify issue resolved.	M24	MLB
	<p>Inspect logic board and heat sink assembly for any damage that may have occurred during removal or replacement.</p> <p>Logic board and heat sink assembly must be treated as a single unit during removal or replacement. All screws must be removed from both components prior to physically pulling or pushing either component.</p> <p>Any mishandling of heat sink assembly that is attached to logic board can cause damage to heat pipes connecting these components.</p> <p>If heat pipes become even slightly damaged (bent or kinked for example), normal heat removal cycle can become disrupted, causing a repetitive hammering noise from this area. Damage may not be visibly noticeable.</p> <p>Noise may be mistaken for a faulty hard drive. Check for this noise with hard drive and fan disconnected.</p> <p>Is there noise coming from logic board and heat sink assembly?</p>	No	Go to step 19.	\$(nodeText.noSymptomCode)	
19.	<p>Noise may be related to interference from other electrical devices operating near computer or plugged into same power outlet. See whether noise is eliminated when computer runs in a different location on a different circuit.</p> <p>Has noise been eliminated?</p>	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

	Check	Result	Action	Code	Commodity
20.	Confirm that the computer's noise, hum, or vibration has been eliminated.	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
	<p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

Stand/Hinge Issues

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Bent standBroken hingeStripped screw/headStripped screw boss/threadsLoose stand and/or hinge <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">Inspect the computer and discuss the nature of issue with the user. Determine whether the user wants to proceed with repair (despite possible accidental damage) or pursue other service options.Click “No” to proceed with further troubleshooting. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug it from AC mains by disconnecting both ends of the power cord. Ensure the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">TP833: iMac and Displays: Power Supply Cover InstructionsTP820: iMac (27-inch): SafetyTP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none">TP1620: iMac Pro (2017): Power Supply Cover InstructionsTP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Determine cause of damage or defects: user/technician, environment, accidental damage, or abuse.	Yes	ESCALATION REQUIRED. Contact ACS for assistance with Apple-related accidental damage.	X99	
	Is an Apple agent responsible for damage or defect on the computer?	No	Go to step 2.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
2.	Inspect stand to determine whether it requires replacement.	Yes	ESCALATION REQUIRED. Replace stand. Verify issue resolved.	X99	
	Verify that stand securely holds computer in its upright position without wobbling when placed on a hard, smooth, even surface.		Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty .		
	Is stand damaged or defective?	No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	Inspect hinge mechanism to determine whether it requires replacement.	Yes	Replace hinge mechanism. Verify issue resolved.	X12	PIECE PART
	Adjust computer back and forth on its hinge, listening for hinge noise. Check feel of the hinge. Its movement should feel firm—not tight or loose—as it holds the iMac in position. Hinge should operate smoothly along its entire travel.		Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or AppleCare Protection Plan. Refer to www.apple.com/legal/warranty .		
	Is hinge mechanism damaged or defective?	No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	Place the customer's iMac on a solid, flat surface.	Yes	ESCALATION REQUIRED. Replace the rear enclosure. Verify issue resolved.	X99	
	Have another person apply downward pressure to the stand to hold it down on that solid surface.		Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty .		
	Firmly grasp both sides of the iMac enclosure, and gently attempt to rotate the entire enclosure left and right while facing the display. The enclosure should not be able to move in this direction.	No	Contact ACS for additional support regarding warranty coverage for this part.	\$(nodeText.noSymptomCode)	
	Compare this behavior with a known-good, similar iMac model.		Go to step 5.		
	If the enclosure rotates an abnormal amount, the mechanism mounts inside the rear enclosure may no longer be securely attached, which may require a rear enclosure replacement.				
	Does the iMac's enclosure rotate an abnormal amount?				

	Check	Result	Action	Code	Commodity
5.	Place the user's iMac on a solid, flat surface and check if one side of the display appears to sit higher or lower than the other side.	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
	Does one side of the iMac appear to sit higher or lower than the other side?	No	Go to step 6.	\${nodeText.noSymptomCode}	
6.	Verify that both stand and hinge operate properly and that they securely hold the iMac upright in all appropriate positions. Is the issue resolved?	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

Intermittent Shutdown

Unlikely causes:

Battery, camera, camera/microphone/ALS cable or camera cable, DisplayPort cable, left speaker, memory, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antennas, wireless card

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"> • Shuts down during startup • Shuts down unexpectedly during use • Computer restarts spontaneously • Turns off when waking from sleep <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>Note: Verify the issue after using the computer for a few minutes to warm it, or by following steps in HT207571: Warm a Mac for testing. Doing this may help identify intermittent issues.</p> <ol style="list-style-type: none"> 1. Run Mac Resource Inspector (MRI) to verify correct operation of sensors and fan. 2. Check for and apply latest software and firmware updates. 3. Inspect fan performance during operation to make sure fan is spinning. Check that vents are not blocked, and if necessary, use compressed air to remove dust or debris from rear fan exhaust. 4. Compare computer's operating temperature to a known-good, similarly configured computer. 5. Check for runaway applications using the information in article HT203184: See how apps affect Mac performance, battery runtime, temperature, and fan activity. Follow the instructions to halt any processes that are using excessive system resources. 6. Processor-intensive/graphics-intensive applications and system processes may cause the enclosure to feel warm. Use Activity Monitor to identify these types of programs and explain issue to user. 7. Reset SMC using the procedure listed for this computer in HT201295: How to reset the System Management Controller (SMC) on your Mac to return computer to a known power-off state. Try to turn on from power-off state. Do not hold in the power button when turning on the computer. You could inadvertently put the computer into DFU mode if you do. 8. Verify that computer's internal hard drive or flash storage is an Apple-installed part. Compare hard drive information in System Information to the Apple Hard Drives Matrix in article SM155: Hard Drives Matrix to determine whether user's installed drive is one of OEM drives available for this computer configuration. Third-party hard drives without correct firmware or thermal sensors, or outside this computer's specifications, may cause computer to run hot or permanently activate fan at full speed. In such cases, inform user that computer has been modified from its original, supported configuration, and that such a repair would not be covered under Apple warranty. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP833: iMac and Displays: Power Supply Cover Instructions • TP820: iMac (27-inch): Safety • TP914: iMac (21.5-inch): Safety <p>For iMac Pro (2017), refer to articles:</p> <ul style="list-style-type: none"> • TP1620: iMac Pro (2017): Power Supply Cover Instructions • TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Run diagnostics or Mac Resource Inspector (MRI) and consult diagnostic logs to check for fan (motor) or sensor failures. Sensors that indicate they are out of normal operating range or an inoperative fan can cause intermittent shutdowns. Refer to service documentation for sensor information. Does computer pass all MRI checks?	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 5.	`\${nodeText.noSymptomCode}`	
2.	Start up from internal drive and attempt to reproduce shutdown symptom(s). Can you reproduce shutdown event?	Yes	Go to step 3.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 4.	`\${nodeText.noSymptomCode}`	
3.	Connect a known-good Apple wired keyboard and Apple wired mouse to user's computer. Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. Does shutdown issue persist?	Yes	ESCALATION REQUIRED. Contact ACS for further assistance.	M99	
		No	Repair disk directory using Disk Utility. If the issue persists after repair, refer to article HT201260: How to find the macOS version number on your Mac and install the correct macOS version and build on user's hard drive. Check for and apply latest software and firmware updates. Verify issue resolved.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
4.	Run ASD or AST 2 extended memory tests, if available, repeatedly to verify that the computer does not unexpectedly shut down.	Yes	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M08	MLB
	Did computer shut down unexpectedly?	No	No failure found during repeated diagnostic testing. Using correct positioning, return computer to user with no trouble found. Verify that the issue is resolved.	\${nodeText.noSymptomCode}	
5.	Determine specific type of failure reported in diagnostics: thermal/fan sensor or voltage/current sensor.	Voltage/Current Sensor	Go to step 6.	\${nodeText.yesSymptomCode}	
	<ul style="list-style-type: none"> • MRI thermal sensors begin with Txxx. • MRI electrical voltage sensors begin with Vxxx. • MRI electrical current sensors begin with Ixxx. Which sensor failure does diagnostics report?	Thermal/Fan Sensor	Go to step 12.	\${nodeText.noSymptomCode}	
6.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Go to step 7.	\${nodeText.yesSymptomCode}	
	Remove display panel. Some power-related sensors are located in power supply, but are read through a SMBus connection to logic board. Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. Does MRI report a VDxx or IDxx test failure?	No/Other	Go to step 10.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
7.	Reseat DC power cable connection to logic board. Reassemble and retest, using MRI. Does MRI still report a VDxx or IDxx sensor test failure?	Yes	Go to step 8.	`\${nodeText.yesSymptomCode}`	
		No	Issue resolved by reseating DC power cable connection between power supply and logic board. Verify resolution.	`\${nodeText.noSymptomCode}`	
8.	To troubleshoot this issue completely, a known-good power supply is required. Do you have immediate access to a known-good power supply?	Yes	Go to step 9.	`\${nodeText.yesSymptomCode}`	
		No	DC power cable is part of power supply. Replace power supply. Verify that the issue is resolved.	P02	POWER SUPPLY
9.	Substitute a known-good power supply, reassemble and retest using MRI. Does MRI still report a VDxx or IDxx sensor test failure?	Yes	Reinstall user's power supply. Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M08	MLB
		No	DC power cable is part of power supply. Replace power supply. Verify that the issue is resolved.	P02	POWER SUPPLY
10.	Most voltage and current regulators are located on logic board. To troubleshoot this issue completely, a known-good logic board is required. Do you have immediate access to a known-good logic board?	Yes	Go to step 11.	`\${nodeText.yesSymptomCode}`	
		No	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M08	MLB

	Check	Result	Action	Code	Commodity
11.	Substitute a known-good logic board, reassemble and retest using MRI. Does MRI still report a Vxxx or lxxxx sensor test failure?	Yes	Reinstall user's logic board. Replace power supply. Verify issue resolved.	P02	POWER SUPPLY
		No	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M08	MLB
12.	Identify specific type of failure reported in MRI/diagnostics: thermal sensor or fan (motor) error. MRI thermal sensors begin with Txxx. Which sensor failure does diagnostics report?	Fan (Motor)	Go to step 13.	\${nodeText.yesSymptomCode}	
		Thermal	Go to step 19.	\${nodeText.noSymptomCode}	
13.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding. Remove display panel. Refer to the service guide Functional Overview to locate affected fan connection to logic board. Disconnect fan cable connectors and inspect logic board and fan cable connector pins for damage. Is there any cable or connector damage on fan or logic board?	Yes	Go to step 14.	\${nodeText.yesSymptomCode}	
		No	Go to step 16.	\${nodeText.noSymptomCode}	
14.	Identify whether fan, logic board, or both are damaged. Are both fan and logic board damaged?	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	\${nodeText.yesSymptomCode}	
		No	Go to step 15.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
15.	Identify whether fan or logic board is damaged. Which part is damaged?	Fan	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
		Logic Board	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M24	MLB
16.	Remove all fan screws and extract fan to reveal heat sink or fan air duct. Use an ESD-safe vacuum to remove dust or debris from inner side of heat sink fin stack. Clean fan rotor blades. Reinstall fan and reseal fan cable connections to logic board. Reassemble and retest with MRI. Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. Does computer pass fan motor check?	Yes	Issue resolved by cleaning fan and heat sink and reseating fan connections. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 17.	`\${nodeText.noSymptomCode}`	
17.	To troubleshoot this issue completely, a known-good fan is required. Do you have immediate access to a known-good fan?	Yes	Go to step 18.	`\${nodeText.yesSymptomCode}`	
		No	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
18.	Substitute a known-good fan, and retest using MRI. Does computer now pass fan motor check?	Yes	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
		No	Reinstall user's fan. Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M08	MLB

	Check	Result	Action	Code	Commodity
19.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Go to step 20.	`\${nodeText.yesSymptomCode}`	
	Remove display panel. Remove all fan screws and extract fan to reveal heat sink or fan air duct. Use an ESD-safe vacuum to remove dust or debris from inner side of heat sink fin stack. Clean fan rotor blades. Reinstall fan and reseal fan cable connections to logic board. Reassemble and retest with MRI. Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. Does MRI still report a Txxx thermal sensor test failure?	No	Issue resolved by cleaning fan and heat sink and reseating fan connections. Verify resolution.	`\${nodeText.noSymptomCode}`	
20.	Identify whether a thermal sensor that is currently failing MRI test is related to the logic board. Refer to service documentation for thermal sensor information and locations. Is a logic board thermal sensor failing a test?	Yes	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M23	MLB
		No	Go to step 21.	`\${nodeText.noSymptomCode}`	
21.	Identify whether a thermal sensor that is currently failing MRI test is related to the Hard Disk Drive (HDD) or Flash Storage. Note: Some models do not have a HDD.	Yes	Go to step 22.	`\${nodeText.yesSymptomCode}`	
	Is a hard drive or flash storage thermal sensor failing a test?	No	Go to step 26.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
22.	Verify in article SM155: Hard Drives Matrix that the installed hard drive or flash storage model is compatible with this computer configuration. Is installed HDD or flash storage compatible with this model?	Yes	Go to step 23.	`\${nodeText.yesSymptomCode}`	
		No	Unsupported HDD or Flash Storage installed, or missing/incorrect hard drive thermal sensor. Check with user for out-of-warranty resolution. Verify resolution.	`\${nodeText.noSymptomCode}`	
23.	Identify the type of storage device affected: <ul style="list-style-type: none"> • Hard Disk Drive (HDD) • Flash Storage Is the affected device an HDD or flash storage?	HDD	Go to step 24.	`\${nodeText.yesSymptomCode}`	
		Flash Storage	Replace the user's flash storage. Verify issue resolved.	H85	SSD
24.	To troubleshoot this issue completely, a known-good hard drive data cable or hard drive combo cable (depending on model) is required. Do you have immediate access to a known-good hard drive data cable or hard drive combo cable?	Yes	Go to step 25.	`\${nodeText.yesSymptomCode}`	
		No	Replace the user's hard drive. Verify issue resolved.	H85	HDD
25.	Substitute a known-good hard drive data cable or hard drive combo cable (depending on model) and retest using MRI. Does computer now pass the THxx sensor check?	Yes	Replace the user's hard drive data cable or hard drive combo cable (depending on model). Verify issue resolved.	X03	INTERNAL CABLE
		No	Reinstall user's hard drive data cable or combo cable (depending on model). Replace the user's hard drive. Verify issue resolved.	H85	HDD
26.	Identify whether a thermal sensor that is currently failing MRI test is related to the power supply. Is a power supply thermal sensor failing a test?	Yes	Replace power supply. Verify issue resolved.	P02	POWER SUPPLY
		No	Go to step 27.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
27.	<p>Identify whether a thermal sensor that is currently failing MRI test is related to the display.</p> <p>Is a display thermal sensor failing a test?</p>	Yes	Go to step 28.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	
28.	<p>To troubleshoot this issue completely, a known-good display panel is required.</p> <p>Do you have immediate access to a known-good display panel?</p>	Yes	Go to step 29.	\${nodeText.yesSymptomCode}	
		No	Replace display panel. Verify issue resolved.	L85	LCD
29.	<p>Substitute a known-good display panel and retest using MRI.</p> <p>Does MRI still report a TL0p or TL1p thermal sensor test failure?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	\${nodeText.yesSymptomCode}	
		No	Replace display panel. Verify issue resolved.	L85	LCD
30.	<p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

Kernel Panic / System Crashes

Unlikely causes:

Battery, DisplayPort cable, left speaker, power supply, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antenna(s)

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Computer displays a kernel panic alert message• Computer freezes during use• Computer freezes upon wake from sleep• Computer freezes when Wi-Fi is enabled or activated <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>Note: Verify the issue after using the computer for a few minutes to warm it, or by following steps in HT207571: Warm a Mac for testing. Doing this may help identify intermittent issues.</p> <ol style="list-style-type: none">1. Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See article HT201314: About macOS Recovery.2. Refer to HT201260: How to find the macOS version number on your Mac to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. Remember that third-party software can contribute to this issue. It may be necessary to check for and apply third-party updates that may not appear in the App store.3. Remove all external devices, except for a known-good USB keyboard and mouse, to help rule out peripherals as a possible cause of this issue.4. Verify memory configuration matches actual amount of installed physical memory.5. Hold Shift key during startup to put computer into safe mode. See HT201262: Use safe mode to isolate issues with your Mac.6. Follow steps outlined in article HT200553: If your Mac spontaneously restarts or displays a message that it restarted or shut down because of a problem.7. If the issue cannot be easily reproduced, Run AST 2 extended memory tests, if available, repeatedly, to verify that the computer does not encounter a crash or kernel panic. <p>Warning: Be extremely careful when working inside the computer when power is applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">• TP1620: iMac Pro (2017): Power Supply Cover Instructions• TP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	A voltage, current, or thermal sensor failure or an inoperative fan can cause kernel panics or system crashes. Run Macintosh Resource Inspector (MRI) or consult MRI logs to check for any sensor or fan failures. Does MRI report any sensor or fan failures?	Yes	Go to “Intermittent Shutdown” troubleshooting flow.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 2.	`\${nodeText.noSymptomCode}`	
2.	Reset SMC using the procedure listed for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac to return computer to a known power-off state. Try to turn on from power-off state. Do not hold in the power button when turning on the computer. You could inadvertently put the computer into DFU mode if you do. Then reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac . Does computer still experience crashes or kernel panics?	Yes	Go to step 3.	`\${nodeText.yesSymptomCode}`	
		No	Issue resolved by SMC/NVRAM reset. Verify resolution. This issue could reoccur if the cause is one of the user's external devices that was not brought in with the computer. Advise user to verify computer is functioning properly by initially leaving all external devices detached, then connecting them one at a time to confirm each device's functionality. If this issue reoccurs, the user should document which external devices are attached and bring them with the computer.	`\${nodeText.noSymptomCode}`	
3.	Ask user which USB device(s) are used with computer when crashes or kernel panics occur. Does user have a USB device that may be causing crashes or kernel panics?	Yes	Go to step 4.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 5.	`\${nodeText.noSymptomCode}`	
4.	Connect a known-good Apple wired keyboard and Apple wired mouse to user's computer. Disconnect user's USB device(s). Test computer with OS or diagnostics. Does computer still experience crashes or kernel panics?	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
		No	ESCALATION REQUIRED. Contact ACS for additional support and latest USB device information.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
5.	<p>Connect a known-good Apple wired keyboard and Apple wired mouse to user's computer.</p> <p>Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Go to step 6.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 9.	`\${nodeText.noSymptomCode}`	
6.	<p>Hold Shift key during startup to put computer into Safe Mode. See article HT201262: Use safe mode to isolate issues with your Mac.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Go to step 7.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 10.	`\${nodeText.noSymptomCode}`	
7.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel and logic board to gain access to memory.</p> <p>Remove all memory modules.</p> <p>While memory is removed, verify that the memory is made by Apple, or third-party memory that meets Apple specifications. Refer to HT205040: iMac memory specifications for more information.</p> <p>Substitute one by one with a known-good memory module.</p> <p>Reseat all memory modules securely in their slots and retest.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Go to step 8.	`\${nodeText.yesSymptomCode}`	
		No	<p>Isolate and replace memory module.</p> <p>Note: Only replace a defective memory module. There is no need to replace memory in pairs.</p> <p>Verify issue resolved.</p>	X01	MEMORY

	Check	Result	Action	Code	Commodity
8.	<p>Check logic board memory slots one by one, using a known-good memory module, to isolate a slot-related failure and retest.</p> <p>Note: Connecting an external display will permit retesting without reinstalling the internal display panel.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>Does crash or kernel panic occur when memory is installed in a specific slot?</p>	Yes	<p>Reinstall user's memory. Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M06	MLB
		No	Go to step 10.	\${nodeText.noSymptomCode}	
9.	<p>Restore macOS on user's flash storage. Refer to HT201260: How to find the macOS version number on your Mac to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Replace the user's flash storage. Verify issue resolved.	H02	SSD
		No	Issue resolved after reinstalling macOS. Verify resolution.	\${nodeText.noSymptomCode}	
10.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove display panel.</p> <p>Locate and disconnect the camera/front microphone/ALS cable from the logic board and camera, and retest computer with OS or diagnostics.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Go to step 18.	\${nodeText.yesSymptomCode}	
		No	Go to step 11.	\${nodeText.noSymptomCode}	
11.	<p>Inspect both ends of the cable, the logic board connector, and the camera connector for any damage.</p> <p>Is there any damage to the camera/front microphone/ALS cable or any connectors?</p>	Yes	Go to step 12.	\${nodeText.yesSymptomCode}	
		No	Go to step 13.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
12.	Determine whether the damage is located on the camera/front microphone/ALS cable, the logic board, the camera, or a combination of multiple components.	Yes	Replace the camera/front microphone/ALS cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
	Is the damage limited to the camera/front microphone/ALS cable only?	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
13.	Reseat camera/front microphone/ALS cable securely to logic board and camera.	Yes	Go to step 14.	\${nodeText.yesSymptomCode}	
	Turn on computer and retest computer with OS or diagnostics. Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. Does computer still experience crashes or kernel panics?	No	Run AST 2 extended memory tests, if available, repeatedly to verify that the computer does not encounter a crash or kernel panic. Verify that the issue is resolved.	\${nodeText.noSymptomCode}	
14.	To troubleshoot this issue completely, a known-good camera/front microphone/ALS cable is required.	Yes	Go to step 15.	\${nodeText.yesSymptomCode}	
	Do you have immediate access to a known-good camera/front microphone/ALS cable?	No	Replace the camera/front microphone/ALS cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
15.	Substitute a known-good camera/front microphone/ALS cable and retest computer with OS or diagnostics.	Yes	Go to step 16.	\${nodeText.yesSymptomCode}	
	Does computer still experience crashes or kernel panics?	No	Replace the camera/front microphone/ALS cable. Verify that the issue is resolved.	X03	INTERNAL CABLE

	Check	Result	Action	Code	Commodity
16.	The camera is part of the display panel in this model.	Yes	Go to step 17.	\${nodeText.yesSymptomCode}	
	To troubleshoot this issue completely, a known-good display panel is required. Do you have immediate access to a known-good display panel?	No	Replace display panel, which includes the camera. Verify issue resolved.	L37	LCD
17.	Substitute a known-good display panel and retest computer with OS or diagnostics. Does computer still experience crashes or kernel panics?	Yes	Replace display panel, which includes the camera. Verify issue resolved.	L37	LCD
		No	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M06	MLB

	Check	Result	Action	Code	Commodity
18.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Go to step 23.	`\${nodeText.yesSymptomCode}`	
	<p>Remove display panel and logic board to gain access to flash storage cards.</p> <p>Disconnect and remove both flash storage cards from the logic board and reassemble the computer. Note from which connector (left or right) that each flash storage card was removed. The cards must be reinstalled into the same connectors from which they were removed, or the computer will not start up. Do not mix up the flash storage cards.</p> <p>Connect an Ethernet cable and power cord to computer, wait five seconds for SMC to reset, then press power button. Hold down Command-Option-R keys during startup to force restart from macOS Internet recovery.</p> <p>This process may take a few minutes for computer to completely start up, depending on speed of your Internet connection. See article HT201314: About macOS Recovery for more information.</p> <p>Does computer still experience crashes or kernel panics?</p>	No	Go to step 19.	`\${nodeText.noSymptomCode}`	
19.	To troubleshoot this issue completely, a known-good matched pair of flash storage modules is required.	Yes	Go to step 20.	`\${nodeText.yesSymptomCode}`	
	<p>Note: Flash storage in this model is in two matched parts, and must be installed properly or the computer will not start up. Refer to service documentation for more information.</p> <p>Do you have immediate access to a known-good flash storage module pair?</p>	No	Go to step 21.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
20.	Substitute known-good flash storage with an up-to-date, bootable version of macOS installed. Refer to HT201260: How to find the macOS version number on your Mac to make sure system build is correct for this computer model.	Yes	Reinstall user's flash storage. Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M06	MLB
	Does computer still experience crashes or kernel panics?	No	Replace user's flash storage. Verify issue resolved.	H02	SSD
21.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Issue resolved after Disk Utility repair. Verify resolution.	\${nodeText.yesSymptomCode}	
	Remove display panel and logic board to gain access to flash storage cards. Reconnect flash storage cards to logic board and reassemble the computer. The cards must be reinstalled into the same connectors from which they were removed, or the computer will not start up. Hold down Command-R during startup to restart from the recovery partition and use Disk Utility to repair user's flash storage. If disk repair is successful, restart and test user's OS. Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. Was Disk Utility repair successful and is crash/kernel panic issue resolved?	No	Go to step 22.	\${nodeText.noSymptomCode}	
22.	Restore macOS on user's flash storage. Refer to HT201260: How to find the macOS version number on your Mac to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.	Yes	Replace the user's flash storage. Verify issue resolved.	H02	SSD
	Does computer still experience crashes or kernel panics?	No	Issue resolved after reinstalling macOS. Verify resolution.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
23.	Use extended version of Cooling System Diagnostics (CSD) to verify proper function of the following subsystems: <ul style="list-style-type: none"> • SMC • Fan • Thermal sensors • CPU–heat sink thermal interface Does computer pass all CSD tests?	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	\${nodeText.yesSymptomCode}	
		No	Go to step 24.	\${nodeText.noSymptomCode}	
24.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding. Remove display panel. Remove all fan screws and extract fan to reveal heat sink or fan air duct. Use an ESD-safe vacuum to remove dust or debris from inner side of heat sink fin stack. Clean fan rotor blades. Reinstall fan and reseal fan cable connections to logic board. Reassemble and retest with CSD.	Yes	Issue resolved by cleaning fan and heat sink and reseating fan connections. Verify resolution.	\${nodeText.yesSymptomCode}	
	Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. Does computer pass all CSD checks?	No	Go to step 25.	\${nodeText.noSymptomCode}	
25.	To troubleshoot this issue completely, a known-good fan is required.	Yes	Go to step 26.	\${nodeText.yesSymptomCode}	
	Do you have immediate access to known-good fan?	No	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC

	Check	Result	Action	Code	Commodity
26.	Substitute a known-good fan and retest using MRI and CSD. Does computer now pass MRI and CSD tests?	Yes	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
		No	Reinstall user's fan. Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M06	MLB
27.	Run AST 2 extended memory tests, if available, repeatedly to verify that the computer does not encounter a crash or kernel panic Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	\${nodeText.noSymptomCode}	

No Power

Unlikely causes:

Camera/microphone/ALS cable, fan, DisplayPort cable, display panel, left speaker, memory, right speaker, flash storage card, stand, Wi-Fi/Bluetooth antenna(s)

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Computer does not turn onComputer does not turn offNo image on internal or external displaysNo sounds from fanNo Caps Lock LED when key is pressed on wired keyboardNon-operational <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">Verify AC power source.Disconnect all peripherals.Verify user's power cord.Determine whether computer is in power-on state by checking for one or more of the following:<ul style="list-style-type: none">Fan spinning soundDisplay backlight onAny display activityFollow suggested steps in HT204267: If your Mac won't turn on.Reset SMC using the procedure listed for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac. Do not hold in the power button when turning on the computer. You could inadvertently put the computer into DFU mode if you do. <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none">TP1620: iMac Pro (2017): Power Supply Cover InstructionsTP1637: iMac Pro (2017): Safety

Deep Dive

	Check	Result	Action	Code	Commodity
1.	The user may report that the computer will not turn off or the computer will not turn on (no power). Which issue is the user experiencing?	Will Not Turn Off	Go to step 21.	`\${nodeText.yesSymptomCode}`	
		No Power	Go to step 2.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
2.	<p>Connect AC power cord and press power button to start up computer.</p> <p>Check computer for any signs of power activity, such as fan or Caps Lock LED on wired keyboard.</p> <p>Does computer show any signs of power activity?</p>	Yes	Go to step 15.	\$(nodeText.yesSymptomCode}	
		No	Go to step 3.	\$(nodeText.noSymptomCode}	
3.	<p>Inspect user's power cord for wire or connector damage. Also inspect computer AC inlet for signs of arcing or damaged pins, which could affect power cord connections.</p> <p>Did you find any damaged components?</p>	Yes	Go to step 4.	\$(nodeText.yesSymptomCode}	
		No	Go to step 5.	\$(nodeText.noSymptomCode}	
4.	<p>Determine whether damage affects user's power cord, AC inlet, or both.</p> <p>Is damage limited to power cord only?</p>	Yes	Replace user's power cord. Verify issue resolved.	X03	EXTERNAL CABLE
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	\$(nodeText.noSymptomCode}	
5.	<p>Verify that user's power cord is securely plugged into a known-good, grounded electrical outlet that provides adequate voltage and power to operate computer. Ensure power cord is fully seated to AC inlet. Attempt to turn on computer.</p> <p>Does issue persist after reseating power cord?</p>	Yes	Go to step 6.	\$(nodeText.yesSymptomCode}	
		No	Go to step 15.	\$(nodeText.noSymptomCode}	
6.	<p>Substitute a known-good power cord and attempt to turn on computer.</p> <p>Does issue persist with known-good power cord?</p>	Yes	Go to step 7.	\$(nodeText.yesSymptomCode}	
		No	Replace user's power cord. Verify issue resolved.	X03	EXTERNAL CABLE

	Check	Result	Action	Code	Commodity
7.	Reset SMC using the procedure listed for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac . Do not hold in the power button when turning on the computer. You could inadvertently put the computer into DFU mode if you do. Does issue persist after SMC reset?	Yes	Go to step 8.	\${nodeText.yesSymptomCode}	
		No	Issue resolved after SMC reset. Verify resolution.	\${nodeText.noSymptomCode}	
8.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding and allow the power supply and logic board to discharge. Remove display panel. Disconnect, inspect and reseat: <ul style="list-style-type: none"> • AC inlet power to power supply • DC power cable between power supply and logic board • Power button cable to logic board Inspect wires and connectors, looking for pinched or exposed wire, and burnt or damaged connectors and pins. Check all power supply bus bars to ensure they are tightly fastened to the logic board. Follow service guide procedures to tighten any loose bus bars. Also inspect the power supply for any damage, such as components that have become loose or broken off. Did you find any damaged components?	Yes	Go to step 9.	\${nodeText.yesSymptomCode}	
		No	Go to step 10.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
9.	<p>Determine whether damage affects DC power cable only, or additional components such as power supply or logic board connectors. Multiple damaged parts requiring replacement will be escalated to ACS.</p> <p>Is damage limited to DC power cable only?</p>	Yes	<p>DC power cable is part of power supply.</p> <p>Replace power supply.</p> <p>Verify that the issue is resolved.</p>	P16	POWER SUPPLY
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	\${nodeText.noSymptomCode}	
10.	<p>Connect AC power cord and press power button to start up computer.</p> <p>Check computer for any signs of power activity, such as fan or Caps Lock LED on wired keyboard.</p> <p>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP1620: iMac Pro (2017): Power Supply Cover Instructions • TP1637: iMac Pro (2017): Safety <p>Does computer show any signs of power activity?</p>	Yes	Go to step 15.	\${nodeText.yesSymptomCode}	
		No	Go to step 11.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
11.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding and allow the power supply and logic board to discharge.</p> <p>Remove display panel.</p> <p>Locate diagnostic LEDs on logic board. Connect AC power cord. Press the diagnostic button (near diagnostic LEDs on logic board) to activate and view LEDs. Diagnostic LED #1 should turn on.</p> <p>This indicates that:</p> <ul style="list-style-type: none"> the AC power cord is good the power supply signal cable connection to the logic board is good power supply trickle voltage is good <p>Is diagnostic LED #1 on?</p>	Yes	Go to step 12.	\${nodeText.yesSymptomCode}	
		No	Replace power supply. Verify issue resolved.	P01	POWER SUPPLY
12.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding and allow the power supply and logic board to discharge.</p> <p>Disconnect power button cable from logic board to inspect cable and connector for damage. Using a multimeter set as ohm meter, verify continuity between the two pins of the power button when it is pressed. A properly working power button should be open (disconnected) when the button is released and closed (connected) when the button is pressed.</p> <p>For additional information on using a multimeter, see HT3250: Using a digital multimeter.</p> <p>Does power button have continuity when button is pressed and open when released?</p>	Yes	Go to step 13.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Replace the rear enclosure which includes the power button and cable. Verify issue resolved.</p> <p>Rear cover replacement is not normally covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>If the power button issue was not caused by accidental damage, then contact ACS for additional support regarding warranty coverage for this part.</p>	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
13.	Reconnect power button cable to logic board.	Yes	Go to step 14.	\$(nodeText.yesSymptomCode}	
	Connect AC power cord and press power button to start up computer.	No	Replace power supply. Verify issue resolved.	P01	POWER SUPPLY
	Press the diagnostic button (near diagnostic LEDs on logic board) to activate and view LEDs. Diagnostic LEDs #1 and #2 should turn on. This indicates power to computer.				
	Are both diagnostic LED #1 and LED #2 on?				
14.	Check computer for any signs of power activity, such as fan or Caps Lock LED on wired keyboard.	Yes	Go to step 15.	\$(nodeText.yesSymptomCode}	
	Does computer show any signs of power activity?	No	Go to step 17.	\$(nodeText.noSymptomCode}	
15.	Verify whether a video signal appears on display.	Yes	Run Mac Resource Inspector (MRI) to obtain latest test results. Verify issue resolved.	\$(nodeText.yesSymptomCode}	
	Is a video image clearly visible on display?	No	Go to step 16.	\$(nodeText.noSymptomCode}	
16.	On a display with dim or no backlight, shine a bright flashlight onto front of display while carefully checking for a faint image showing graphics, an Apple logo, open windows, or other signs that the system is partially functional.	Yes	Go to “Backlight Issue / No Backlight” troubleshooting flow.	\$(nodeText.yesSymptomCode}	
	Is any video visible with flashlight?	No	Go to “Power But Blank/No Video” troubleshooting flow.	\$(nodeText.noSymptomCode}	
17.	To continue to troubleshoot this issue, a known-good power supply is required.	Yes	Go to step 18.	\$(nodeText.yesSymptomCode}	
	Do you have immediate access to a known-good power supply?	No	Go to step 19.	\$(nodeText.noSymptomCode}	
18.	Important: Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur.	Yes	Replace power supply. Verify issue resolved.	P01	POWER SUPPLY
	Substitute a known-good power supply and attempt to turn on computer.	No	Go to step 19.	\$(nodeText.noSymptomCode}	
	Does computer show any signs of power activity?				

	Check	Result	Action	Code	Commodity
19.	<p>Important: Remove AC power to computer and wait two minutes.</p> <p>Measure the logic board coin battery voltage.</p> <p>Refer to the service guide for information about locating the RTC battery measurement test pads.</p> <p>Carefully touch one multimeter probe to each pad to measure an expected coin battery voltage of 3 volts DC.</p> <p>If the voltage is 2.7 VDC or less, replace the coin battery.</p> <p>For additional information on using a multimeter, see HT3250: Using a digital multimeter.</p> <p>Is the coin battery voltage low (2.7 VDC or less)?</p>	Yes	<p>Replace coin cell battery.</p> <p>Note: Effective immediately, some coin cell batteries used on Mac systems are now available only from electronics parts distributors (for example, MCM). The coin battery is no longer available to order via GSX. Please order this battery from an electronics parts distributor.</p> <p>Note: BR2032 and CR2032 batteries have the same form factor and nominal voltage. However, BR2032 batteries have a lower self-discharge rate and broader operating temperature range than CR2032 batteries for longer shelf and service life.</p> <p>Verify that the issue is resolved.</p>	X32	OTHER ELECTRIC
		No	Go to step 20.	\$(nodeText.noSymptomCode)	
20.	<p>Follow service guide procedures to force-reset the logic board Real-Time Clock (RTC).</p> <p>Refer to the service guide for information about locating the RTC reset test pads and performing the reset procedure.</p> <p>Be extra careful not to touch any other components to avoid damaging logic board.</p> <p>Warning: Do not short-circuit the reset pads for more than a few seconds, as doing so may cause damage to coin battery and/or logic board.</p> <p>Connect AC power cord and press power button to start up computer.</p> <p>Check computer for any signs of power activity, such as fan or Caps Lock LED on wired keyboard.</p> <p>Does computer show any signs of power activity?</p>	Yes	Issue resolved by resetting logic board. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M01	MLB

	Check	Result	Action	Code	Commodity
21.	If any app hangs or freezes when the computer is shutting down, then try to force quit that app. Also check if any software updates are in progress.	Yes	Issue cannot be duplicated.	\$(nodeText.yesSymptomCode}	
		No	Go to step 22.	\$(nodeText.noSymptomCode}	
	Does the computer turn off?				
22.	Press and hold down the power button for 10 seconds or until user's computer powers off.	Yes	Go to step 23.	\$(nodeText.yesSymptomCode}	
		No	Go to step 24.	\$(nodeText.noSymptomCode}	
	Does the computer turn off?				
23.	Reset SMC using the procedure listed for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac . Do not hold in the power button when turning on the computer. You could inadvertently put the computer into DFU mode if you do.	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	\$(nodeText.yesSymptomCode}	
		No	Issue resolved after SMC reset. Verify resolution.	\$(nodeText.noSymptomCode}	
	Does issue persist after SMC reset?				

	Check	Result	Action	Code	Commodity
24.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding and allow the power supply and logic board to discharge.</p> <p>Remove display panel.</p> <p>Disconnect, inspect and reseat:</p> <ul style="list-style-type: none"> • AC inlet power to power supply • DC power cable between power supply and logic board • Power button cable to logic board 	Yes	Go to step 25.	\${nodeText.yesSymptomCode}	
	<p>Inspect wires and connectors, looking for pinched or exposed wire, and burnt or damaged connectors and pins.</p> <p>Check all power supply bus bars to ensure they are tightly fastened to the logic board. Follow service guide procedures to tighten any loose bus bars.</p> <p>Also inspect the power supply for any damage, such as components that have become loose or broken off.</p> <p>Did you find any damaged components?</p>	No	Go step 26.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
25.	<p>Determine whether damage affects power button cable only from main logic board to rear enclosure, or additional components such as power supply or logic board connectors. Multiple damaged parts requiring replacement will be escalated to ACS.</p> <p>Is damage limited to power button cable only?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Replace the rear enclosure which includes the power button and cable. Verify issue resolved.</p> <p>Rear cover replacement is not normally covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>If the power button issue was not caused by accidental damage, then contact ACS for additional support regarding warranty coverage for this part.</p>	<p>\$(nodeText.yesSymptomCode)</p>	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	<p>\$(nodeText.noSymptomCode)</p>	

	Check	Result	Action	Code	Commodity
26.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding and allow the power supply and logic board to discharge.	Yes	No failure found during diagnostic testing. Using correct positioning, return computer to user with no trouble found. Verify issue resolved.	\$(nodeText.yesSymptomCode)	
	<p>Disconnect power button cable from logic board to inspect cable and connector for damage. Using a multimeter set as ohm meter, verify continuity between the two pins of the power button when it is pressed.</p> <p>A properly working power button should be open (disconnected) when the button is released and closed (connected) when the button is pressed.</p> <p>A meter reading of 0 to 0.2 Ω (ohms) means that the power button has continuity (the button is closed or connected).</p> <p>A meter reading of 0.2 Ω (ohms) to ∞ (infinity) means that the power button does not have continuity (the button is open or disconnected).</p> <p>For additional information on using a multimeter, see HT3250: Using a digital multimeter.</p> <p>Does power button have continuity when button is pressed and open when released?</p>	No	<p>ESCALATION REQUIRED.</p> <p>Replace the rear enclosure which includes the power button and cable. Verify issue resolved.</p> <p>Rear cover replacement is not normally covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty.</p> <p>If the power button issue was not caused by accidental damage, then contact ACS for additional support regarding warranty coverage for this part.</p>	\$(nodeText.noSymptomCode)	
27.	Verify that computer can now complete startup process over multiple trials.	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
	<p>Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	\$(nodeText.noSymptomCode)	

Will Not Start Up

Unlikely causes:

Camera/front microphone/ALS cable, fan, DisplayPort cable, left speaker, power supply, rear enclosure, right speaker, stand

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• No display image appears during startup• Some video activity, Apple logo, progress indicator• Prohibitory sign or folder with a flashing question mark• Error beep tones• Audible fan sounds• Caps Lock LED on wired keyboard toggles on and off when pressed <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. In the event that there is an iBridge / macOS version mismatch in the user's computer, iBridge firmware will update automatically while the computer is connected to the Internet. During this process the computer's display can remain completely black for some period of time (at least 30 seconds). If the computer is turned off or disconnected from the Internet during this process under the assumption that something went wrong, the black screen will occur again until the iBridge update has completed. To resolve this issue, plug in the computer, attempt to turn it on, then wait at least one minute to provide an opportunity for any updates to complete if needed. Once completed, the computer should display video once again. For more information, see OP1935: iMac Pro (2017) Service Readiness Guide.2. After logic board replacement, if the computer turns on but displays only a black screen and does not start up, this could mean that the replacement logic board has not yet been configured for use. For complete instructions to configure a replacement logic board, refer to TP1625: iMac Pro (2017): Using the Mac Configuration Utility.3. Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See article HT201314: About macOS Recovery.4. Refer to HT201260: How to find the macOS version number on your Mac to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. Remember that third-party software can contribute to this issue. It may be necessary to check for and apply third-party updates that may not appear in the App store.5. Verify that startup process passes initial memory checks and POST (Power-On Self-Test) with some video activity. If computer generates beeping sounds, there may be an issue with memory. See article HT201702: Intel-based Mac Power-On Self-Test RAM error codes.6. Remove all external devices, except for a known-good USB keyboard and mouse, to help rule out peripherals as a possible cause of this issue.7. Follow suggested steps in HT206182: Helping customers with a Mac that doesn't start up.8. Verify memory configuration matches actual amount of installed physical memory.9. Hold Shift key during startup to put computer into safe mode. See HT201262: Use safe mode to isolate issues with your Mac.10. Reset SMC using the procedure listed for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac to return computer to a known power-off state. Try to turn on from power-off state. Do not hold in the power button when turning on the computer. You could inadvertently put the computer into DFU mode if you do.11. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.12. Run Disk Utility or check Mac Resource Inspector (MRI) results to verify presence and SMART status of user's flash storage.

	<p>13. Identify when during startup process computer hangs in order to isolate the issue. See article HT204156: About the screens you see when your Mac starts up.</p> <p>Warning: Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips, refer to articles:</p> <ul style="list-style-type: none"> • TP1620: iMac Pro (2017): Power Supply Cover Instructions • TP1637: iMac Pro (2017): Safety
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Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>A memory error is indicated by a sequence of one or three beep tones. Refer to article HT201702: Intel-based Mac Power-On Self-Test RAM error codes for more information.</p> <p>Does computer make error beep tones at startup?</p>	Yes	Go to step 11.	\$(nodeText.yesSymptomCode)	
		No	Go to step 2.	\$(nodeText.noSymptomCode)	
2.	<p>Connect AC power cord and press power button to start up computer.</p> <p>Press the diagnostic button (near diagnostic LEDs on logic board) to activate and view LEDs. Diagnostic LED # 3 should turn on. This indicates that memory is functioning.</p> <p>Is the diagnostic LED #3 illuminated?</p>	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
		No	Go to step 11.	\$(nodeText.noSymptomCode)	
3.	<p>Observe startup process to verify that the computer displays an image.</p> <p>Does the computer display an image during startup process?</p>	Yes	Go to step 4.	\$(nodeText.yesSymptomCode)	
		No	Go to “Power But Blank/No Video” troubleshooting flow.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
4.	Verify that computer completes full startup process: Apple logo > progress indicator > login screen > user's desktop.	Yes	Issue cannot be duplicated. If the user reports that the issue is intermittent, repeat steps 2 through 4 multiple times to confirm functionality before returning the computer to the user.	\$(nodeText.yesSymptomCode)	
	Does computer complete startup process to user's desktop?	No	Go to step 5.	\$(nodeText.noSymptomCode)	
5.	Start up computer and determine whether a kernel panic is occurring.	Yes	Go to "Kernel Panic/System Crashes" troubleshooting flow.	\$(nodeText.yesSymptomCode)	
	Does computer display a kernel panic during startup?	No	Go to step 6.	\$(nodeText.noSymptomCode)	
6.	Connect a known-good Apple wired keyboard and Apple wired mouse to user's computer.	Yes	Go to step 9.	\$(nodeText.yesSymptomCode)	
	Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. Does computer start up from recovery partition?	No	Go to step 7.	\$(nodeText.noSymptomCode)	
7.	Restore macOS on user's flash storage. Refer to HT201260: How to find the macOS version number on your Mac to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.	Yes	Go to step 8.	\$(nodeText.yesSymptomCode)	
	Does computer start up from recovery partition?	No	Replace the user's flash storage. Verify issue resolved.	H02	SSD
8.	Verify that computer completes full startup process: Apple logo > progress indicator > login screen > user's desktop.	Yes	Issue resolved after reinstalling macOS. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Does computer complete startup process to user's desktop?	No	Replace the user's flash storage. Verify issue resolved.	H02	SSD

	Check	Result	Action	Code	Commodity
9.	<p>Important: Remove AC power to computer and wait two minutes.</p> <p>Measure the logic board coin battery voltage.</p> <p>Refer to the service guide 'Diagnostic LEDs and Test Pads' article for information about locating the RTC battery measurement test pads.</p> <p>Carefully touch one multimeter probe to each pad to measure an expected coin battery voltage of 3 volts DC.</p> <p>If the voltage is 2.7 VDC or less, replace the coin battery.</p> <p>For additional information on using a multimeter, see article HT3250: Using a digital multimeter.</p> <p>Is the coin battery voltage low (2.7 VDC or less)?</p>	Yes	<p>Replace coin cell battery.</p> <p>Note: Effective immediately, some coin cell batteries used on Mac systems are now available only from electronics parts distributors (for example, MCM). The coin battery is no longer available to order via GSX. Please order this battery from an electronics parts distributor.</p> <p>Note: BR2032 and CR2032 batteries have the same form factor and nominal voltage. However, BR2032 batteries have a lower self-discharge rate and broader operating temperature range than CR2032 batteries for longer shelf and service life.</p> <p>Verify that the issue is resolved.</p>	X32	OTHER ELECTRIC
		No	Go to step 10.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
10.	Follow service guide procedures to force-reset the logic board Real-Time Clock (RTC).	Yes	Issue resolved by resetting logic board. Verify resolution.	\$(nodeText.yesSymptomCode)	
	<p>Refer to the service guide for information about locating the RTC reset test pads and performing the reset procedure.</p> <p>Be extra careful not to touch any other components to avoid damaging logic board.</p> <p>Warning: Do not short-circuit the reset pads for more than a few seconds, as doing so may cause damage to coin battery and/or logic board.</p> <p>Connect AC power cord and press power button to start up computer.</p> <p>Check computer for any signs of power activity, such as fan or Caps Lock LED on wired keyboard.</p> <p>Does computer show any signs of power activity?</p>	No	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M02	MLB
11.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Go to step 12.	\$(nodeText.yesSymptomCode)	
	<p>Remove display panel and logic board to gain access to memory.</p> <p>Remove all memory modules.</p> <p>While memory is removed, verify that the memory is made by Apple, or third-party memory that meets Apple specifications. Refer to HT205040: iMac memory specifications for more information.</p> <p>Reseat all memory modules securely in their slots and retest.</p> <p>Does computer make error beep tones at startup?</p>	No	<p>Issue resolved by reseating memory.</p> <p>Verify resolution.</p>	\$(nodeText.noSymptomCode)	
12.	Typical configurations ship with two memory modules located in first two slots. It is possible to see a configuration with four memory modules installed.	Yes	Go to step 14.	\$(nodeText.yesSymptomCode)	
	Is user's computer configured with four memory modules installed?	No	Go to step 13.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
13.	Keep track of where memory is located as you work in pairs to isolate memory and later verify slot functionality. Remove user memory from second two slots and retest. Does computer indicate a memory error with user memory in first two slots only?	Yes	Go to step 18.	\$(nodeText.yesSymptomCode)	
		No	Go to step 14.	\$(nodeText.noSymptomCode)	
14.	Leave user memory installed in first two slots. Install two known-good memory modules in second two slots and retest. Does computer indicate a memory error with known-good memory in second two slots?	Yes	Replace logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Verify that the issue is resolved.	M07	MLB
		No	Go to step 15.	\$(nodeText.noSymptomCode)	
15.	Leave the known-good memory pair in second two slots. Remove user memory from first two slots and set aside as proven-good user memory. Install the original user memory into first two slots. Retest. Does computer indicate a memory error with original user memory in first two slots?	Yes	Go to step 17.	\$(nodeText.yesSymptomCode)	
		No	Go to step 16.	\$(nodeText.noSymptomCode)	
16.	Leave memory in first two slots as is. Remove known-good memory from second two slots. Install proven-good user memory (previously set aside) into second two slots. Restart computer to verify user memory. Does computer indicate a memory error with user memory?	Yes	ESCALATION REQUIRED. Contact ACS for additional support. Situation: User memory passes test when paired with known-good memory but fails when paired with like user memory.	M99	
		No	Issue resolved by reconfiguring and reseating memory. Verify resolution.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
17.	<p>Remove known-good memory from second two slots, leaving user memory in first two slots. Restart computer to verify user memory in first two slots as standalone with no memory in second two slots.</p> <p>Does computer indicate a memory error with user memory in first two slots only?</p>	Yes	Go to step 18.	\$(nodeText.yesSymptomCode)	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support.</p> <p>Situation: User memory (currently located first two slots) fails when paired with known-good memory and passes when known-good memory is removed from adjacent slots.</p>	M99	
18.	<p>Remove user memory module from first slot and substitute a known-good memory module into same first slot. Retest.</p> <p>Does computer indicate a memory error with one known-good and one user module in first two slots?</p>	Yes	Go to step 19.	\$(nodeText.yesSymptomCode)	
		No	<p>Replace defective memory.</p> <p>Note: You may not return non-Apple memory as KBB. Please verify Apple memory using MRI before returning to Apple.</p> <p>Verify issue resolved.</p>	X02	MEMORY
19.	<p>Keep known-good memory module in first slot and substitute second slot module with a second known-good memory module. Keep track of suspect user memory removed from second slot. Testing both first two slots with known-good memory will verify error is either defective slots or defective memory.</p> <p>Does computer indicate a memory error using two known-good memory modules in first two slots?</p>	Yes	<p>Replace logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Verify that the issue is resolved.</p>	M07	MLB
		No	Go to step 20.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
20.	Install first user memory module (removed from first slot) into second memory slot and test paired with a known-good memory module still in first slot.	Yes	Replace both user memory modules in first two slots. Note: You may not return non-Apple memory as KBB. Please verify Apple memory using MRI before returning to Apple. Verify issue resolved.	X02	MEMORY
	Does computer indicate a memory error?	No	Replace defective memory. Note: You may not return non-Apple memory as KBB. Please verify Apple memory using MRI before returning to Apple. Verify issue resolved.	X02	MEMORY
21.	Verify that computer can now complete startup process over multiple trials.	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
	Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

About Apple service certifications

Topic

To learn more about accessing [ATLAS](#) and service exams, review these articles:

- [How to get a Tech ID](#)
- [ATLAS frequently asked questions](#)
- [How to access Apple service exams at Pearson VUE](#)

Note: Apple Retail Store employees must read [Understanding Exam and Certification requirements](#) (RS228), in addition to this procedure.

Exams and courses that you need to service iOS products

Training for Apple Certified iOS Technician (ACiT) 2018 is available to technicians who work at Apple-authorized service facilities. Technicians need a Global Service Exchange (GSX) account to see the courses in [ATLAS](#).

To register for any ACiT exam, use [Pearson VUE](#).

ACiT 2018 certification

With ACiT 2018 certification, you can service iOS devices such as iPhone and iPad after passing the following exams:

- Apple Service Fundamentals Exam (SVC-18A) or (SVC-17A)
- ACiT 2018 iOS Service Certification Exam (iOS-18A)

ACiT 2017 certification

Important: If you are not already ACiT 2017 certified, complete the ACiT 2018 exam instead.

With ACiT 2017 certification, you can service iPhone, iPad, Apple Watch and Apple TV devices after passing the following exams:

- Apple Service Fundamentals Exam (SVC-17A)
- ACiT 2017 iOS Service Certification Exam (iOS-17A)

Please note that the following devices have additional requirements:

- iPad Pro (12.9-inch) (2nd Generation), iPad Pro (10.5-inch), iPad Pro (9.7-inch), iPad Pro, iPad (5th Generation), iPad (6th Generation) and iPad mini 4
 - Also complete the Troubleshooting iPad course in ATLAS.
- iPhone 8 and iPhone 8 Plus
 - Also complete the Servicing iPhone 8 and 8 Plus course in ATLAS.
- iPhone X
 - Also complete the Servicing iPhone X course in ATLAS

ACiT 2016 certification

With ACiT 2016 certification, you can service iPhone, iPad, Apple Watch and Apple TV devices after passing these exams:

- Apple Service Fundamentals Exam (SVC-16A)
- ACiT 2016 iOS Service Certification Exam (iOS-16A)

Please note that the following devices have additional requirements:

- iPad Pro (12.9-inch) (2nd Generation), iPad Pro (10.5-inch), iPad Pro (9.7-inch), iPad Pro, iPad (5th Generation), iPad (6th Generation) and iPad mini 4
 - Also complete the Troubleshooting iPad course in ATLAS.
- iPhone 7, iPhone 7 Plus
 - Also complete the Servicing iPhone 7 and iPhone 7 Plus course in ATLAS.
- iPhone 8 and iPhone 8 Plus
 - Also complete the Servicing iPhone 8 and 8 Plus course in ATLAS.
- iPhone X
 - Also complete the Servicing iPhone X course in ATLAS

Exams and courses that you need to service Mac products

Training for Apple Certified Mac Technician (ACMT) 2018 is available to technicians who work at Apple-authorized service facilities. Technicians need a Global Service Exchange (GSX) account to view the courses in [ATLAS](#). To register for any ACMT exam, use [Pearson VUE](#).

ACMT 2018 certification

With ACMT 2018 certification, you can service Mac computers after passing these exams:

- Apple Service Fundamentals Exam (SVC-18A) or (SVC-17A)
- ACMT 2018 Mac Service Certification Exam (MAC-18A)

ACMT 2017 certification

Important: If you're not already ACMT, ACMT 2015, ACMT 2016 or ACMT 2017 certified, complete the ACMT 2018 exams instead.

With ACMT 2017 certification, you can service most Mac computers after passing these exams:

- Apple Service Fundamentals Exam (SVC-17A)
- ACMT 2017 Mac Service Certification Exam (MAC-17A)

These computers have additional requirements:

- MacBook (Retina, 12-inch, 2017):
 - Also complete the MacBook (Retina, 12-inch, 2017), Trackpad Calibration Check and Interpreting Liquid Contact Indicators (LCIs) courses in ATLAS
- MacBook Air (11-inch, Mid 2013, Early 2014, and Early 2015) and MacBook Air (13-inch, Mid 2013, Early 2014, and 2017):
 - Also complete the MacBook Air course in ATLAS.
- MacBook Pro (13-inch, 2017, Four Thunderbolt 3 Ports) and MacBook Pro (15-inch, 2017):
 - Also complete the MacBook Pro with Four Thunderbolt 3 Ports course in ATLAS and the Trackpad Calibration Check course in ATLAS
- MacBook Pro (13-inch, 2016, Two Thunderbolt 3 Ports) and MacBook Pro (13-inch, 2017, Two Thunderbolt 3 Ports):
 - Also complete the MacBook Pro with Two Thunderbolt 3 Ports course in ATLAS and the Trackpad Calibration Check course in ATLAS
- iMac Pro (2017):
 - Also complete the Servicing iMac Pro (2017) course in ATLAS
- iMac (2017):
 - Also complete the iMac (2017) course in ATLAS

ACMT 2016 certification

If you're not already ACMT 2016 certified, complete the ACMT 2018 exams instead.

With ACMT 2016 certification, you can service most Mac computers (some have additional requirements) after passing these exams:

- Apple Service Fundamentals Exam (SVC-16A)
- ACMT 2016 Mac Service Certification Exam (MAC-16A)

These computers have additional requirements:

- MacBook (Retina, 12-inch, 2017):
 - Also complete the MacBook (Retina, 12-inch, 2017), Trackpad Calibration Check, and Interpreting Liquid Contact Indicators (LCIs) courses in ATLAS
- MacBook (Retina, 12-inch, Early 2016):
 - Also complete the MacBook (Retina, 12-inch, Early 2016) course in ATLAS, and the Trackpad Calibration Check course in ATLAS.
- MacBook Air (11-inch, Mid 2013, Early 2014, and Early 2015) and MacBook Air (13-inch, Mid 2013, Early 2014, Early 2015, and 2017)
 - Also complete the MacBook Air course in ATLAS
- MacBook Pro (15-inch, 2016 and 2017):
 - Also complete the MacBook Pro with Four Thunderbolt 3 Ports course in ATLAS and the Trackpad Calibration Check course in ATLAS
- MacBook Pro (13-inch, 2016 and 2017, Four Thunderbolt 3 Ports):
 - Also complete the MacBook Pro with Four Thunderbolt 3 Ports course in ATLAS and the Trackpad Calibration Check course in ATLAS
- MacBook Pro (13-inch, 2016 and 2017, Two Thunderbolt 3 Ports):
 - Also complete the MacBook Pro with Two Thunderbolt 3 Ports course in ATLAS and the Trackpad Calibration Check course in ATLAS

- iMac Pro (2017):
 - Also complete the Servicing iMac Pro (2017) course in ATLAS
- iMac (2017):
 - Also complete the iMac (2017) course in ATLAS
- iMac (Late 2015):
 - Also complete the iMac (Late 2015) course in ATLAS.

ACMT 2015 certification

If you're not already ACMT 2015 certified, complete the ACMT 2018 exams and courses instead.

With ACMT 2015 certification, you can service many Mac computers (some have additional requirements) if you passed these exams:

- OS X Yosemite Troubleshooting Exam (9L0-066)
- Mac Hardware Service Exam (9L0-012)

These computers have additional requirements:

- MacBook (Retina, 12-inch, 2017):
 - Also complete the MacBook (Retina, 12-inch, 2017), Trackpad Calibration Check, and Interpreting Liquid Contact Indicators (LCIs) courses in ATLAS
- MacBook (Retina, 12-inch, Early 2016):
 - Also complete the MacBook (Retina, 12-inch, Early 2016) course in ATLAS, and the Trackpad Calibration Check course in ATLAS.
- MacBook (Retina, 12-inch, Early 2015):
 - Also complete the MacBook (Retina, 12-inch, Early 2015) course in ATLAS, and the Trackpad Calibration Check course in ATLAS
- MacBook Air (11-inch, Mid 2013, Early 2014, and Early 2015) and MacBook Air (13-inch, Mid 2013, Early 2014, Early 2015 and 2017):
 - Also complete the MacBook Air course in ATLAS
- MacBook Pro (15-inch, 2016 and 2017):
 - Also complete the MacBook Pro with Four Thunderbolt 3 Ports course in ATLAS and the Trackpad Calibration Check course in ATLAS
- MacBook Pro (13-inch, 2016 and 2017, Four Thunderbolt 3 Ports):
 - Also complete the MacBook Pro with Four Thunderbolt 3 Ports course in ATLAS and the Trackpad Calibration Check course in ATLAS
- MacBook Pro (13-inch, 2016 and 2017, Two Thunderbolt 3 Ports):
 - Also complete the MacBook Pro with Two Thunderbolt 3 Ports course in ATLAS and the Trackpad Calibration Check course in ATLAS
- MacBook Pro (Retina, 13-inch, Early 2015):
 - Also complete the MacBook Pro 13-inch (2012 to 2015) course in ATLAS
- MacBook Pro (Retina, 15-inch, Mid 2015):
 - Also complete the MacBook Pro 15-inch (2012 to 2015) course in ATLAS, and the Trackpad Calibration Check course in ATLAS
- iMac Pro (2017):
 - Also complete the Servicing iMac Pro (2017) course in ATLAS
- iMac (2017):
 - Also complete the iMac (2017) course in ATLAS
- iMac (Late 2015):
 - Also complete the iMac (Late 2015) course in ATLAS.

ACMT certification

If you're not already ACMT certified, complete the ACMT 2018 exams and courses instead.

With ACMT certification, you can service certain Mac computers (some have additional requirements) after passing these exams:

- Mac OS X Mavericks Troubleshooting Exam (9L0-065)
- Mac Hardware Service Exam (9L0-011)

These computers have additional requirements. (Some of these exams and courses are not currently available.)

- MacBook (Retina, 12-inch, 2017):
 - Also complete the MacBook (Retina, 12-inch, 2017), Trackpad Calibration Check, and Interpreting Liquid Contact Indicators (LCIs) courses in ATLAS
- MacBook (Retina, 12-inch, Early 2016):
 - Also complete the MacBook (Retina, 12-inch, Early 2016) course in ATLAS, and the Trackpad Calibration Check course in ATLAS.
- MacBook (Retina, 12-inch, Early 2015):

- Also complete the MacBook (Retina, 12-inch, Early 2015) course in ATLAS, and the Trackpad Calibration Check course in ATLAS
- MacBook Air (11-inch, Mid 2013, Early 2014, and Early 2015) and MacBook Air (13-inch, Mid 2013, Early 2014, Early 2015 and 2017):
 - Also complete the MacBook Air course in ATLAS
- MacBook Pro (15-inch, 2016 and 2017):
 - Also complete the MacBook Pro with Four Thunderbolt 3 Ports course in ATLAS and the Trackpad Calibration Check course in ATLAS
- MacBook Pro (13-inch, 2016 and 2017, Four Thunderbolt 3 Ports):
 - Also complete the MacBook Pro with Four Thunderbolt 3 Ports course in ATLAS and the Trackpad Calibration Check course in ATLAS
- MacBook Pro (13-inch, 2016 and 2017, Two Thunderbolt 3 Ports):
 - Also complete the MacBook Pro with Two Thunderbolt 3 Ports course in ATLAS and the Trackpad Calibration Check course in ATLAS
- MacBook Pro (Retina, 15-inch, Mid 2015):
 - Also complete the MacBook Pro 15-inch (2012-2015) course in ATLAS, and the Trackpad Calibration Check course in ATLAS
- MacBook Pro (Retina, 13-inch, Late 2012 to Early 2015):
 - Also complete the MacBook Pro 13-inch (2012 to 2015) course in ATLAS
- MacBook Pro (Retina, Mid 2012) and MacBook Pro (Retina, 15-inch, Early 2013 to Mid 2014):
 - Also complete the MacBook Pro 15-inch (2012 to 2015) course in ATLAS
- iMac Pro (2017):
 - Also complete the Servicing iMac Pro (2017) course in ATLAS
- iMac (2017):
 - Also complete the iMac (2017) course in ATLAS
- iMac (Late 2015):
 - Also complete the iMac (Late 2015) course in ATLAS.
- iMac (Late 2012 to Mid 2015 models)
 - Also complete the iMac (2012 to 2015) course in ATLAS.
- Mac Pro (Late 2013):
 - Also complete the Mac Pro (Late 2013) course in ATLAS

About the Apple Service Fundamentals Exam (SVC-18A)

The Apple Service Fundamentals Exam (SVC-18A) is a computer-based knowledge text that Pearson VUE offers online. The test is open resource and test takers should use Apple references and courses in ATLAS to help answer the exam items.

Successful completion of this exam fulfills the prerequisite for Apple Certified iOS Technician (ACiT) 2018 certification and Apple Certified Mac Technician (ACMT) 2018 certification. The SVC-18A exam must be successfully completed before taking the Mac or iOS certification exams.

Exam summary

- Number of sections: 5
- Number of learning objectives: 34
- Number of total items: 70
- Passing score: 80 percent overall (at least 56 out of 70 items to pass)
- Exam time limit: 2 hours

Seven demographic questions are presented at the beginning of the exam. These items aren't scored and don't use the 2 hours given for the exam.

Two separately scored sections must be passed

The exam has two separately-scored sections that each must be passed to pass the entire exam. This is in addition to the overall passing score listed above. The two sections are listed below:

- The ESD Precautions section (at least 10 out of 12 questions answered correctly to pass)
- The Safety section (at least 10 out of 12 questions answered correctly to pass)

Sections and topics

Here are the sections and topics covered in Apple Service Fundamentals Exam:

Customer Experience (23 items)

- Identify the probing skills that result in getting good information from the customer
- Select good examples of reflecting and summarizing the customer's answers in order to come to agreement on the issue
- Identify ways to properly position a repair so that the customer knows why it is necessary and is

- in agreement with the strategy
- Identify ways to position and recommend upgrades and attachments as part of an alternative service strategy.
- Demonstrate use of the “Positive No” in a series of choose-the-phrase exercises
- List practical applications of the four cornerstones of adult learning
- Describe the effect of both complex technical language and over-simplified language
- Identify good examples of phrases to help set accurate customer expectations
- Describe the role of empathy in customer satisfaction
- Identify ways to avoid conflict by using genuine empathy
- Identify causes for conflict in an interaction
- Identify the five-step anger diffusion technique given a customer scenario
- Assess and explain the impact of non-verbal communication

ESD Precautions (12 items)

- Correctly identify and practice ESD precautions
- Correctly identify the components of an ESD-compliant workstation
- Use the proper tools, equipment, and procedures to configure a workspace that minimizes or eliminates the occurrence of electrostatic discharge damage
- Correctly identify the effects of ESD damage on an integrated circuit
- Correctly identify common ESD myths and why they are not true

Safety (12 items)

- Identify those customer statements that will generate a Safety First issue
- Explain the importance of exercising special care when handling lithium-ion/polymer batteries
- Demonstrate the proper and safe handling of batteries
- Recognize and identify signs and symptoms of damaged batteries
- Respond to events involving embedded batteries

Troubleshooting (8 items)

- Identify the different stages of troubleshooting and service where diagnostic tools are useful
- List the components of clear, concise and complete case notes
- Demonstrate basic troubleshooting and deductive reasoning skills
- Use smart questioning techniques and first-level evaluation and isolation skills to identify issues as being generally hardware based, software based, educational, or environmental in nature

Product Knowledge (15 items)

- List and understand basic iOS controls and navigation
- Identify the components of the default macOS user environment
- List Apple Watch controls and Navigation
- Given a customer scenario, evaluate, isolate, and resolve an Apple ID related issue
- List the steps to configure Continuity services in macOS and in iOS
- Describe how to configure a Bluetooth device in an Apple product
- Identify the methods for backing up and restoring data on an Apple product

Courses in ATLAS

To prepare for the Apple Service Fundamentals Exam, we suggest that you review the courses in the 2018 Service Fundamentals subject area in ATLAS. The list of courses in the suggested order can be found in [2018 Service Fundamentals](#).

About the ACiT 2018 iOS Service Certification Exam (iOS-18A)

The ACiT 2018 iOS Service Certification Exam is a computer-based knowledge test that Pearson VUE offers online. This is an open-resource test. We encourage you to use Apple references and courses in ATLAS to answer the questions.

To earn Apple Certified iOS Technician (ACiT) 2018 certification, you need to pass this exam (iOS-18A) and the Apple Service Fundamentals Exam (SVC-18A).

Please note: The Apple Service Fundamentals Exam must be taken before you take the iOS Service Certification Exam.

Exam summary

- Number of sections: 2
- Number of learning objectives: 18
- Number of total items: 70

- Passing score: 80 percent overall (at least 56 out of 70 items to pass)
- Exam time limit: 2 hours

Seven demographic questions are presented at the beginning of the exam. These items aren't scored and don't use the 2 hours given for the exam.

Sections and topics

Here are the sections and topics covered in ACiT Exam:

Troubleshooting (38 items)

- Describe the diagnostics used in troubleshooting a given scenario
- Given an isolated issue, categorize the issue as either hardware (including accidental damage), software, environmental, or educational opportunity
- Order the steps in the iOS setup and activation process
- List common resolutions for battery-related issues
- Identify basic controls for mailbox management
- Describe the built-in apps and features of iOS
- Describe how to personalize and customize iPhone General and Accessibility settings
- Describe the privacy settings that can be put in place for apps

Servicing iPhone (32 items)

- Identify the physical supplies and online resources necessary to ensure proper and safe servicing of an iPhone model
- Given a simulated workstation, identify the supplies that are necessary to reduce the possibility of being harmed while servicing iPhone
- Identify the tools that are commonly used to service all iOS models
- Identify the correct specialized tools, fixtures, and procedures required to service iPhone 5s
- Identify the correct specialized tools, fixtures, and procedures required to service iPhone 5c
- Identify the correct specialized tools, fixtures, and procedures required to service iPhone 6 and iPhone 6 Plus
- Identify the correct specialized tools, fixtures, and procedures required to service iPhone 6s and iPhone 6s Plus
- Identify the correct specialized tools, fixtures, and procedures required to service iPhone SE
- Identify the correct specialized tools, fixtures, and procedures required to service iPhone 7 and iPhone 7 Plus
- Identify the correct specialized tools, fixtures, and procedures required to service iPhone 8 and 8 Plus
- Identify the correct specialized tools, fixtures, and procedures required to service iPhone X

Courses in ATLAS

To prepare for the ACiT 2018 iOS Service Certification Exam (iOS-18A), we suggest that you review the courses in the ACiT 2018 subject area in ATLAS. The list of courses in the suggested order can be found in [ACiT 2018 Overview](#).

About the ACMT 2018 Mac Service Certification Exam (MAC-18A)

The ACMT 2018 Mac Service Certification Exam (MAC-18A) is a computer-based knowledge test that Pearson VUE offers online. This is an open-resource test. We encourage you to use Apple references and courses in ATLAS to answer the questions.

To earn Apple Certified Mac Technician (ACMT) 2018 certification, you need to pass this exam (MAC-18A) and the Apple Service Fundamentals Exam (SVC-18A).

Please note: You must complete the Apple Service Fundamentals Exam before you take the Mac Service Certification Exam.

Exam summary

- Number of sections: 2
- Number of learning objectives: 28
- Number of total items: 70
- Passing score: 80 percent overall (at least 56 out of 70 items to pass)
- Exam time limit: 2 hours

Seven demographic questions are presented at the beginning of the exam. These items aren't scored and don't use the 2 hours given for the exam.

Sections and topics

Here are the sections and topics covered in ACMT Exam:

Troubleshooting (36 items)

- Evaluate and isolate file system issues with macOS-based systems
- Given a network related customer issue, accurately evaluate, isolate and resolve the issue
- Correctly identify the diagnostic tool most appropriate to a given troubleshooting scenario
- Describe how to use troubleshooting tools and related procedures
- Identify potential startup issues and associated fixes
- Identify macOS migration tools needed for migration, the types of user data that can be migrated, and the correct methods for migrating user data from both a Mac and PC
- Identify the symptoms that are a result of an SMC that is not functioning correctly
- Explain how to maximize the battery life of an Apple product
- Identify the process to create, configure, manage, and delete user accounts in macOS
- Configure FileVault 2 in macOS to secure the data on a Mac
- Describe the data privacy concerns that are presented when Location Services is enabled in macOS
- Describe the method for resetting a lost Firmware (EFI) password
- Describe how to use Time Machine in macOS to create, restore, and manage a secure data backup

Repairing the Mac Family (34 items)

- Given a simulated workstation, identify the supplies that are necessary to reduce the possibility of damaging the customer's Mac while servicing the computer
- Given a simulated workstation, identify the supplies that are necessary to reduce the possibility of being harmed while servicing Mac models
- Demonstrate the proper and safe handling of batteries and portable computer case assemblies with built-in battery
- Identify specialized tools, fixtures or procedures required to service iMac
- Identify safety precautions necessary to safely service iMac models
- Identify specialized tools, fixtures or procedures required to service iMac Pro
- Identify safety precautions necessary to safely service iMac Pro models
- Identify specialized tools, fixtures or procedures required to service Mac mini
- Identify specialized tools, fixtures or procedures required to service MacBook Pro 13-inch models
- Identify internal connector types for specific MacBook Pro 13-inch models
- Identify specialized tools, fixtures or procedures required to service MacBook Pro 15-inch models
- Identify internal connector types for specific MacBook Pro 15-inch models
- Identify specialized tools, fixtures or procedures required to service MacBook Air
- Identify specialized tools, fixtures or procedures required to service Mac Pro
- Identify internal connector types for specific Mac Pro models
- Identify safety precautions necessary to safely service Mac Pro models
- Identify specialized tools, fixtures or procedures required to service MacBook

Courses in ATLAS

To prepare for the ACMT 2018 Mac Service Certification Exam (MAC-18A), we suggest that you review the courses in the ACMT 2018 subject area in ATLAS. The list of courses in the suggested order can be found in [ACMT 2018 Overview](#).

Frequently Asked Questions

Can anyone take the service certification exams?

Yes. Anyone can take the exams to become an Apple Certified Mac Technician (ACMT) 2018 or Apple Certified iOS Technician (ACiT) 2018. To pass these exams, you need to have access to the training in [ATLAS](#).

Successfully completing the exams doesn't mean that Apple has authorized you to perform repairs or to conduct business directly with Apple or on Apple's behalf. Apple certifies (verifies the skills of) technicians. Apple authorizes (establishes business relationships with) service providers. These two things aren't the same.

How do I register for the exams?

Go to certifications.apple.com to register and create a Tech ID. Then use your [Tech ID](#) to register at an Apple Authorized Training Center or online with Pearson VUE. After you've taken an Apple certification exam, you can track and manage all of your Apple certifications at the certifications website.

How do I prepare for the service certification exams?

Apple provides self-paced training courses in ATLAS through Global Service Exchange (GSX). Apple Authorized Service Providers (AASPs) and Self-Servicing Accounts (SSAs) can get the Service Training curriculum online for free.

The Apple Service Fundamentals Exam (SVC-18A) has sections on ESD precautions and technician safety. You must pass these sections in order to pass the exam as a whole.

If I don't pass an exam, how soon can I retake it?

You can retake an exam 24 hours after completing the last attempt.

How do I pay for the exams?

When you register for the certification exams, you can pay with Visa, MasterCard, or American Express.

Where can I verify my exams or certification status?

To verify your exam and certification status, go to certifications.apple.com. In the "Certification" tab, look for the corresponding Certification Name in "My Certifications" and verify that the status is "Certified". To view exam details, click the relevant Certification Name.

I checked my certification status at certifications.apple.com and it is "In Progress". What does that mean?

If your certifications status is "In Progress", it signifies that not all requirements for the certification were completed. To achieve "Certified" status, some certifications require one or more additional courses or exams to be completed.

I have certifications on two different TechIDs. What should I do?

Your TechIDs will need to be manually updated. Send an email to certifications@apple.com with your exam results and TechID information.

I passed my exam, but when I checked my certification it is not on certifications.apple.com. Why is my certification missing?

Your certifications may take up to 72 hours to appear on certifications.apple.com after you pass the exam. If it has been longer, please send an email to certifications@apple.com.

I have other questions. Where can I get them answered?

You can send your questions to svc.trng@apple.com.

Questions about Apple Certified iOS Technician (ACiT) 2018

What is ACiT 2018?

It's a program to become Apple-certified as an iOS technician.

How is ACiT 2018 different from previous ACiT 2017 certification?

ACiT 2018 qualifies a technician to repair iOS products that were produced before April 2018. This includes:

- iPhone 8 and iPhone 8 Plus
- iPhone X
- iPad (6th generation)

What exams are required for ACiT 2018?

To get ACiT 2018 certification, you need to pass the Apple Service Fundamentals Exam (SVC-18A) or (SVC-17A) and the ACiT 2018 iOS Service Certification Exam (iOS-18A). These exams are available from Pearson VUE. You can take the exams online from your own computer.

Does it matter in what order I take the exams?

Yes. Before you can register for the ACiT 2018 iOS Service Certification Exam (iOS-18A), you must pass the Apple Service Fundamentals Exam.

How much does each exam cost?

The cost of the exam is \$20 USD (2,215 yen for Japan). Current pricing is available from Apple Authorized Training Centers or [Pearson VUE](#).

Where do I find the training for these exams?

Training for these exams is available in [ATLAS](#). Access ACiT 2018 courses at Apple-authorized service facilities.

I'm already ACiT 2017 certified. Do I need to take the new ACiT 2018 exams?

No. If you're certified for the iOS products you need to repair, no new exams are required.

Will separate iOS qualification exams be required for new iOS products?

No. Apple will introduce new qualification courses in ATLAS as products are introduced. You have to complete these courses to service these new products.

I've completed the SVC-17A exam. How long will the iOS-17A exam be available? Do I need to take two new exams for ACiT certification?

If you've completed the SVC-17A for ACiT 2017, the ACiT exam will be available until July 27, 2018. Until then, completion of SVC-17A and iOS-17A exams will still grant you ACiT 2017 certification, but it won't cover as many products. To get ACiT 2018 certification, the SVC-18A and iOS-18A exams are required.

What will I have to do to service new iOS products that are introduced after I'm certified?

Apple will introduce new qualification courses in ATLAS as products are introduced. You have to complete these courses to service these new products.

I have completed the Apple Certified Mac Technician (ACMT) 2018 certification. Do I need to take two new exams for ACiT certification?

No. If you're ACMT 2018 certified, you've passed the Apple Service Fundamentals Exam. You only need to pass the ACiT 2018 iOS Service Certification Exam (iOS-18A) to be ACiT 2018 certified.

When I complete the requirements for ACiT 2018, will I get a printed certificate?

Yes. After you pass the required exams, send an email to certifications@apple.com and ask for a certificate. You'll get an email with a link to the request form.

I have other questions. Where can I get them answered?

You can send your questions to svc.trng@apple.com.

Questions about Apple Certified Mac Technician (ACMT) 2018

What is ACMT 2018?

Apple Mac Technician (ACMT) 2018 is a new version of the Apple Certified Mac Technician certification.

How is ACMT 2018 different from previous ACMT certifications?

ACMT 2018 qualifies a technician to repair all the Mac products that were covered by prior ACMT certifications, plus all other Mac products that were produced before April 2018. This includes MacBook and MacBook Pro products that required a separate qualification exam or course in ATLAS:

- MacBook (Retina, 12-inch, 2017)
- MacBook Air (2017)
- MacBook Pro (13-inch, 2017, Four Thunderbolt 3 Ports)
- MacBook Pro (13-inch, 2017, Two Thunderbolt 3 Ports)
- MacBook Pro (15-inch, 2017)
- iMac Pro (2017)
- iMac (2017)

ACMT 2018 allows a technician who works at an Apple-authorized service facility to service all of these products.

What exams are required for ACMT 2018?

To get ACMT 2018 certification, you need to pass the Apple Service Fundamentals Exam (SVC-18A) or (SVC-17A) and ACMT 2018 Mac Service Certification Exam (MAC-18A). These exams are available from Pearson VUE. You can take the exams online from your own computer.

Does it matter in what order I take the exams?

Yes. Before you can register for the ACMT 2018 Mac Service Certification Exam (MAC-18A), you must pass the Apple Service Fundamentals Exam.

How much do each of the exams cost?

The cost of the exam is \$20 USD (2,215 yen for Japan). Current pricing is available from Apple Authorized Training Centers or [Pearson VUE](#).

Where do I find the training for these exams?

Training for these exams is available in [ATLAS](#). You can access ACMT 2018 courses at Apple authorized service facilities.

I'm already ACMT 2017 certified. Do I need to take the new ACMT 2018 exams?

No. If you're certified for the Mac products you need to repair, no new exams are required.

I've completed the Apple Certified iOS Technician (ACiT 2018) certification. Do I need to take two new exams for ACMT certification?

No. If you're ACiT 2018 certified, you've already passed the Apple Service Fundamentals Exam. You only need to take and pass the ACMT 2018 Mac Service Certification Exam (MAC-18A) to be ACMT 2018 certified.

Will separate Mac qualification exams still be available?

Apple will publish new qualification courses in ATLAS for new Apple products as needed. If you're already ACMT certified and want to repair a product with separate course requirements, you'll be able to do so.

I've completed one of the previous ACMT 2017 exams. Do I need to take two new exams for ACMT certification?

If you've completed the SVC-17A exam for ACMT, the remaining ACMT exam will be available until July 27, 2018. Until then, completion of SVC-17A and MAC-17A exams will still grant you ACMT 2017 certification, but it won't cover as many products. To get ACMT 2018 certification, the SVC-18A / SVC-17A and MAC-18A exams are required.

What will I have to do to service new Mac products that are introduced after I'm certified?

Apple will introduce new qualification courses in ATLAS as products are introduced. You have to complete these courses to service the new products.

When I complete the requirements for ACMT 2018, will I get a printed certificate?

Yes. After you pass the required exams, send an email to certifications@apple.com and ask for a certificate. You'll get an email with a link to the request form.

I have other questions. Where can I get them answered?

You can send your questions to svc.trng@apple.com.

Required Tools

Required Tools for iMac (Late 2012 – 2017) and iMac Pro (2017) Models

The following tools are required to service these models:

- iMac Pro (2017)
- iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017)
- iMac (27-inch, Late 2012 and Late 2013)
- iMac (Retina 4K, 21.5-inch, Late 2015 and 2017)
- iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014, Late 2015, 2017)

For more information about tools, refer to article [OP101: Apple notebooks and desktops: Hand Tools for Repairs](#).

General Tools

- ESD-safe workstation, including an ESD mat and wrist or heel strap
- ESD bags, to store ESD-sensitive parts while removed from the computer
- ESD-safe tweezers.
- Black stick or other nonconductive nylon or plastic flat-bladed tool
 - Black stick, pack of 4 (922-5065)
 - Black stick, pack of 24 (922-9004)
 - Black stick, pack of 96 (922-9005)
- Digital volt meter, for troubleshooting
- Earphones, for audio cable reassembly
- Kapton tape
- Magnifying glass, for reading the serial number
- Pentalobe driver (923-0367), for VESA mount
- Phillips #00 screwdriver
- Sticky notes
- Thunderbolt and USB cables, for logic board replacement
- Torx T4 screwdriver (magnetized)
- Torx T5 screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- Torx T8 screwdriver (magnetized)
- Torx T10 screwdriver (magnetized)
- Torx T25 screwdriver (magnetized), for 27-inch models
- Adjustable torque driver 0.3–1.2 Nm (923-0735)
- T8 security bit (923-0734)
- Logic Board Service Tray (076-00376)

Display Tools

The display is secured to the rear enclosure using adhesive strips. When a repair requires the removal of the display panel, the very high bond (VHB) adhesive strips must be cut and replaced.

Display starter kit and refill kits

Model	Starter kit	Refill kit
iMac (21.5-inch, Late 2012)	076-1444	076-1437
iMac (21.5-inch, Early 2013)	076-1444	076-1437
iMac (21.5-inch, Late 2013)	076-1444	076-1437
iMac (21.5-inch, Mid 2014)	076-1444	076-1437
iMac (21.5-inch, Late 2015)	076-1444	076-1437
iMac (21.5-inch, 2017)	076-00330	076-00331
iMac (Retina 4K, 21.5-inch, Late 2015)	076-1444	076-1437
iMac (Retina 4K, 21.5-inch, 2017)	076-00330	076-00331
iMac (27-inch, Late 2012)	076-1444	076-1419
iMac (27-inch, Late 2013)	076-1444	076-1419
iMac (Retina 5K, 27-inch, Late 2014)	076-1444	076-00009
iMac (Retina 5K, 27-inch, Mid 2015)	076-1444	076-00009
iMac (Retina 5K, 27-inch, Late 2015)	076-1444	076-00009
iMac (Retina 5K, 27-inch, 2017)	076-00330	076-00332
iMac Pro (2017)	076-00374	076-00375

Display starter kit contains:

- Display removal tool (1) (the white handle shown here), also available separately as 076-00108
- Display removal wheels (8) (the black circle on the left side of tool shown here)



- iMac service foam locking wedge (not available separately)

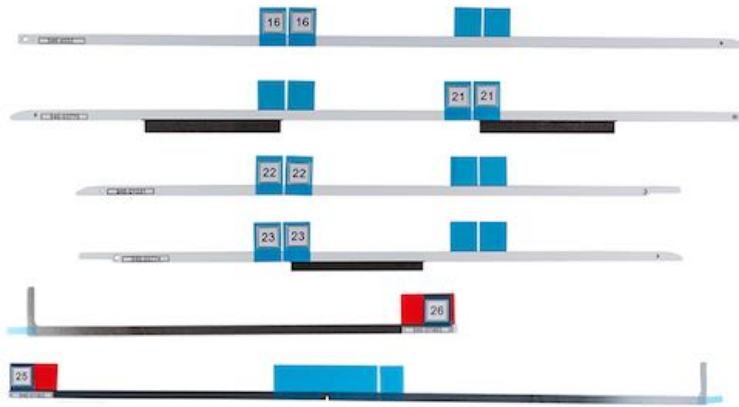
Note: The number on the side of the foam wedge (944-4365) is an Apple internal part number used for identification. It is not an orderable service part.



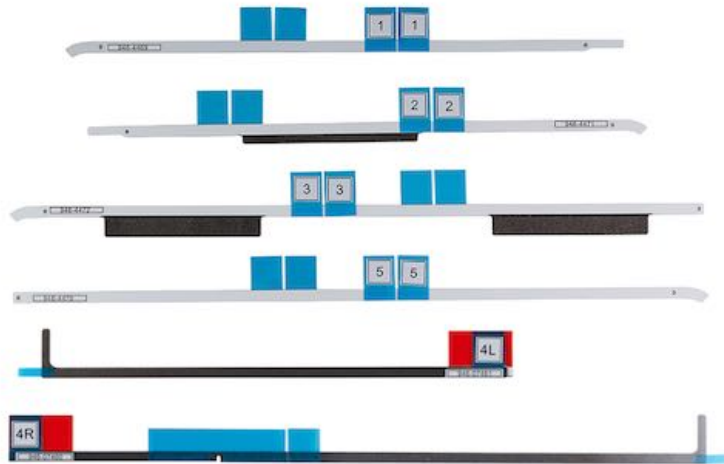
- VHB adhesive strip 6-piece set for iMac Pro (2017)



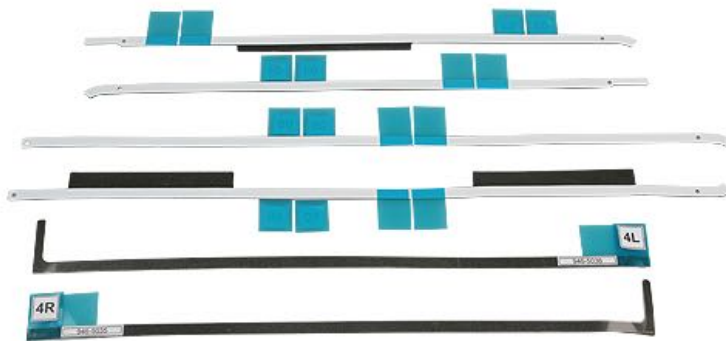
- VHB adhesive strip 6-piece set for iMac (27-inch, 2017) (4 sets)



- VHB adhesive strip 6-piece set for iMac (21.5-inch, 2017) (4 sets)



- VHB adhesive strip 6-piece set for iMac (21.5-inch, Late 2012–Mid 2015 models)



Display refill kits contain:

- Display removal tool (1), also available separately as 076-00108
- Display removal wheels (20), also available separately as 076-1417
- VHB adhesive strip 6-piece set (20 sets)

Other display tools:

- Display cable extension kit, to test the display panel and cables with the display panel removed
 - 076-1428 for iMac (21.5-inch, Late 2012–2017 models)
 - 076-00200 for iMac (Retina 4K and 2.8 GHz, 21.5-inch, Late 2015)
 - 076-1431 for iMac (27-inch, Late 2012 and Late 2013)
 - 076-00010 for iMac (Retina 5K, 27-inch, Late 2014, Mid 2015, Late 2015, 2017) models, iMac (Retina 4K, 21.5-inch, 2017), and iMac Pro (2017)
- Display removal tool (076-00108)
- Display removal wheels, pack of 20 (076-1417)
- ESD bags, 27x18-inch, pack of 5 (923-01193), for a 27-inch display
- ESD bags, 21x16-inch, pack of 5 (923-01194), for a 21.5-inch display
- Isopropyl alcohol (IPA) wipes, 95% or higher isopropyl
- LCD service support stand (923-0416), to support the LCD panel or when working on a VESA mount-adapted system



- Painter's tape (tape that does not leave a residue, 1 to 2 inches wide, but preferably 2-inch, if available)
- Polishing cloths, anti-static, optical-grade microterry, pack of 5 (922-8263)
- Power supply protective covers (923-0189), to use when performing live adjustments with the display panel removed
- Sticky silicone roller (6-inch) (922-8261), to adhere VHB strips to the display panel
- Sticky sheet pads (922-8262), to clean silicone roller or pick up shards of broken glass

Wireless Card Tools

- Thermal pad kit (076-1445)
Note: Whenever removing or replacing the wireless card, check for any original thermal material. If it is present, then remove the original thermal material, clean the area with an IPA wipe, and install one thermal pad to the wireless card.
- Antenna removal tool (optional)
 - 923-01322



- Wireless card support tools
 - 923-02218 for iMac Pro (2017)



- 923-01806 for iMac (21.5-inch, 2017) and iMac (Retina 4K, 21.5-inch, 2017)



- 923-01807 for iMac (Retina 5K, 27-inch, 2017)



- 923-00774 for iMac (21.5-inch, Late 2015) and iMac (Retina 4K, 21.5-inch, Late 2015)



- 923-00775 for iMac (Retina 5K, 27-inch, Late 2015)



Power Supply Cover Instructions



WARNING: HIGH VOLTAGE: The power supply remains powered up whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. Avoid touching the logic board or power supply while the computer is plugged in.

- Never remove or install any physical components while the computer is plugged in to an electrical outlet.
- When plugged in, the power supply and logic board are energized, even when the computer is powered off.
- Unplug computer and allow sufficient time for the power supply and logic board to self-discharge before removing display panel.
- Do NOT touch the logic board or power supply while the computer is plugged in, or before sufficient time has passed to discharge stored voltage to a safe level after being unplugged.

Discharge wait time:

- Wait two minutes after unplugging the computer from the electrical outlet before removing display panel, disconnecting modules, or substituting cables and components. This will allow the power supply and logic board time to discharge.

Electrical Safety Precautions:

Before working on a computer with exposed, potentially energized parts:

- Remove rings, watches, necklaces, metal-rimmed eyewear, and other metallic articles which increase your risk of electric shock.
- Do not wear a cell phone or other signaling device, as these may cause a dangerous startle reflex during energized work.
- **If the iMac needs to be plugged in for LED checks or similar troubleshooting, do NOT wear an ESD wrist strap.** Wearing ESD grounding systems increases your risk of electric shock.
- Remain alert, focused on the work being performed, and aware of the proximity of grounded objects to your body.
- Use the plastic black stick or other non-metal extension tool as needed to connect or disconnect cables, to keep fingers away from potentially energized parts.

Tools Required

- A ruler
 - Kapton tape or painter's tape
 - Power supply protective cover, 923-0189, pkg. of 2
1. Before using the power supply cover for the first time, position the cover with the part number face-down, then fold the cover once to create a 90-degree bend. The fold location is marked by a linear indentation (see dotted line in image) in the cover. Use a ruler as a guide to make the fold.



2. The pre-formed bends allow the cover to fit the rear housing on a variety of iMacs and displays (as shown).
3. Secure the power supply cover with Kapton or painter's tape as shown below.



Warning: Place a cover over the power supply when doing live adjustments. Avoid touching the power supply while the computer is plugged in.

4. The power supply protective cover may be reused. However, before reusing, visually inspect for:
 - Holes, tears, punctures, or cuts.
 - Textural defects such as swelling, softening, hardening, or stickiness.

- Other defects that degrade insulating quality.

5. If any wear or other defects are found, discard and use a new cover (923-0189).

Safety

Safety for iMac Pro (2017)



Warning: HIGH VOLTAGE. Use extreme caution when troubleshooting with the display panel removed. Avoid touching the logic board or power supply while the computer is plugged in, the power supply retains a charge whether or not the computer is on.

After unplugging the computer from the electrical outlet, wait two minutes before removing the display panel, disconnecting modules, or substituting cables and components. This will allow the power supply and logic board time to discharge.

- Never remove or install any physical components while the computer is plugged in to an electrical outlet.
- When plugged in, the power supply and logic board are energized, even when the computer is turned off.
- Unplug the computer and allow sufficient time for the power supply and logic board to self-discharge before removing the display panel.
- Do NOT touch the logic board or power supply while the computer is plugged in, or before sufficient time has passed to discharge stored voltage to a safe level after being unplugged.

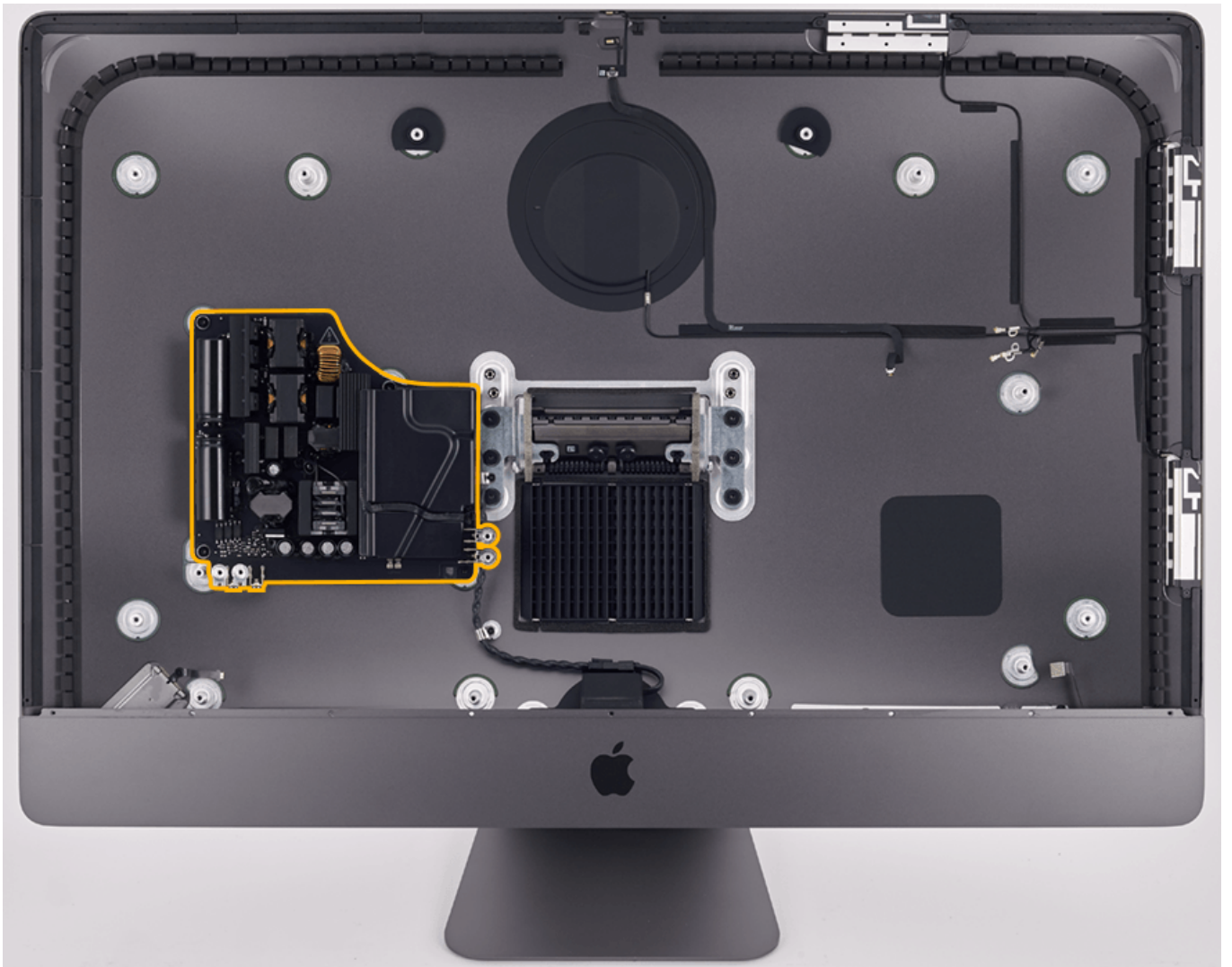
Refer to article [TP1620: iMac Pro \(2017\): Power Supply Cover Instructions](#) for additional information on installing the protective covers. The power supply cover provides protection against unintended contact with the energized power supply, which may result in injury from electric shock. ALWAYS use the protective power supply cover during service when the glass panel and LCD have been removed from the iMac Pro (2017).

Electrical Safety Precautions

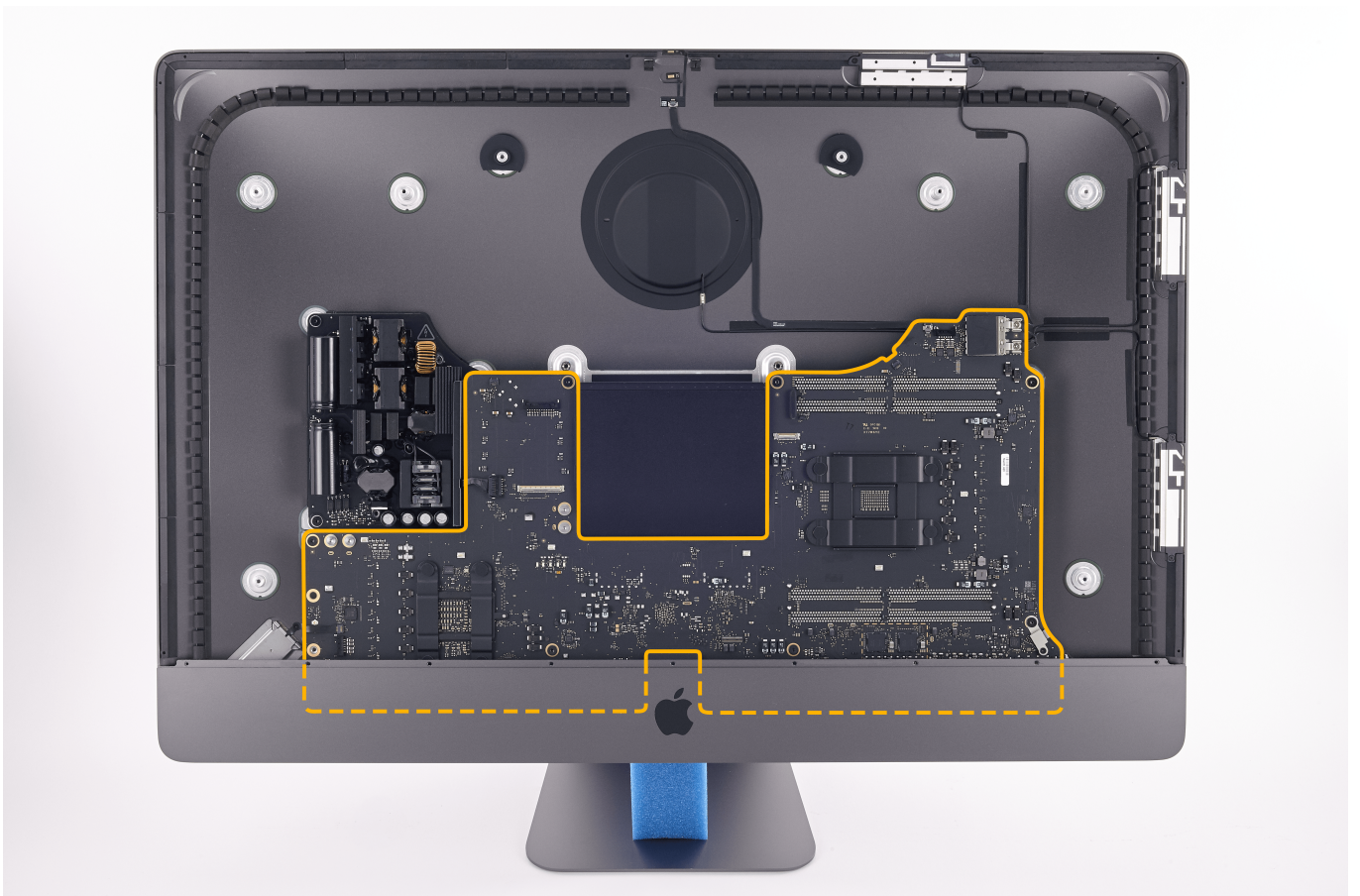
Before working on a computer with exposed, potentially energized parts:

- Remove rings, watches, necklaces, metal-rimmed eyewear, and other metallic articles which increase your risk of electric shock.
- Do not wear a cell phone or other signaling device, as these may cause a dangerous startle reflex during energized work.
- **If the iMac needs to be plugged in for LED checks or similar troubleshooting, do NOT wear an ESD wrist strap.** Wearing an ESD grounding system increases your risk of electric shock in this situation.
- Remain alert, focused on the work being performed, and aware of the proximity of grounded objects to your body.
- Use the plastic black stick or other non-metal extension tool as needed to connect or disconnect cables, to keep fingers away from potentially energized parts.

Power Supply Location



Logic Board Location



Protective Power Supply Cover Placement

Warning: Use the protective power supply covers when the computer is plugged in or when performing live adjustments. On these models, place a cover over both the power supply and the logic board when doing live adjustments. Secure the covers to the rear housing with tape, as shown below. Avoid touching the logic board or power supply while the computer is plugged in and the display panel is removed.

Refer to articles:

- [TP1620: Power Supply Cover Instructions](#)
- [TP981: Testing the Panel Using the Display Extension Cable Kit](#)



Cleaning and Handling a Broken Display Panel

Cleaning and Handling a Broken Display Panel for iMac (Late 2012–2017) and iMac Pro (2017)

Tools for Cleaning the Display Panel

- Safety glasses
- Service wedge (iMac) (included with the display panel starter kit, 076-1444)
- Clean, damp cloth (to clean display panel glass)
- Isopropyl alcohol (IPA) wipes (to remove residual VHB adhesive)

Cleaning the Display Panel

1. Clean the front of the display with a clean, damp, lint-free cloth. **Note:** Do not use IPA wipes to clean the display. IPA wipes should only be used to remove residual VHB adhesive.
2. Polish the display panel with an antistatic, microterry, optical-grade polishing cloth (922-8263, package of five).



Glass Safety Precautions

All models have a glass display panel that attaches to the front of the computer, which must be removed to access internal components.

Handling a Broken Display Panel

- The display panel's glass is not tempered and will break into sharp pieces if mishandled. Removing the display panel requires special tools.
- Safety glasses are recommended when removing the display panel.

Tools

- Display panel starter kit (Refer to [TP818: Required Tools](#) for part numbers.)
- Material handling gloves (such as leather or cut-resistant gloves)
- Packing tape or equivalent
- Safety glasses

- Large ESD bags (922-8258) – 24x20-inch bags that accommodate a 21.5-inch display, package of five
- Large ESD bags (922-9468) – 24x30-inch bags that accommodate a 27-inch display, package of five
- Large box for disposal

Safety Information



If the display panel breaks and a glass shard enters the eye:

- Seek medical attention immediately!
- Do not rub your eye if you feel you have something in your eye.
- Do not use an eye wash. An eye wash can push or move the shard of glass and cause more damage.
- Keep the eye closed or loosely patch the eye to keep the eye from moving.



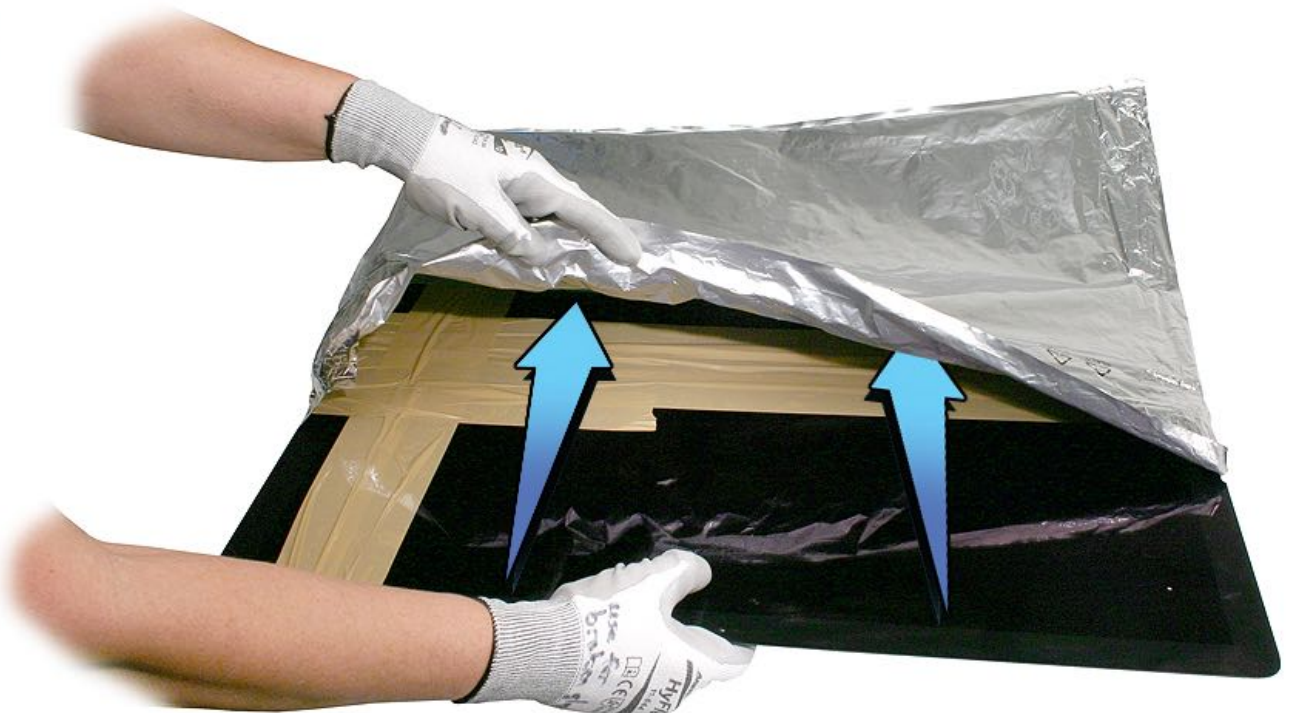
Handling a Broken Display Panel

1. Put on safety glasses and material handling gloves.
2. If the display panel is broken and is still attached to the rear housing, then secure the broken glass with packing tape and carefully follow the Display Panel Removal procedure.
 - [RP1021: iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\): Display Panel Removal](#)
 - [RP1230: iMac \(21.5-inch, Late 2015 and 2017\) and iMac \(Retina 4K, 21.5-inch, Late 2015 and 2017\): Display Panel Removal](#)
 - [RP950: iMac \(27-inch\) Display Panel Removal](#)
 - [RP1403: iMac Pro \(2017\) Display Panel Removal](#)
3. Lay the display panel on a smooth, clean work surface.
4. Apply tape, thoroughly covering the broken display panel.



4.

5. Place the taped display panel in the ESD bag that the replacement panel came in (or an equivalent large bag).



6. Place the display panel inside a large box, label the box "Broken Glass," and return the display back to Apple using the normal return process.



Take Apart Procedure Notes

Reassembly Steps

When no replacement steps are listed, replace parts in exact reverse order of Removal procedure.

Note About Images in This Guide

In some cases a pre-production model may have been used to document the procedures in this guide. Although there may be small differences in appearance between the image pictured and the computer you are servicing, the procedures are the same unless noted.

Screw Sizes

All screw sizes shown are approximate and represent the total length of the screw.



Display Panel Removal

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

For video instruction, refer to article [SV364: Display Panel Replacement Video](#).

Before you begin:

- Shut down the computer.
- Unplug power and disconnect peripherals.
- Put on an ESD wrist strap.



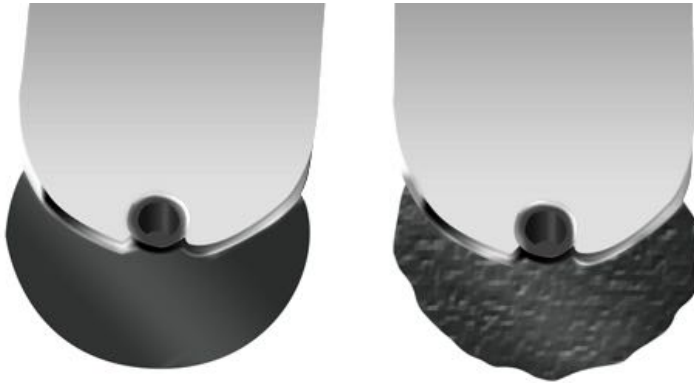
Tools

- ESD wrist strap
- Service wedge (iMac)
- ESD-safe bag (not pictured)
- Black stick
- Display removal tool
- Replacement wheels for display removal tool (several)
- Safety glasses



The display panel must be removed for all repairs. The display is affixed to the computer housing with very high bond (VHB) adhesive strips. These VHB strips must be cut with the display removal tool in order to remove the LCD panel. Each VHB strip consists of two adhesive layers and a foam layer (VHB/foam/VHB). When you remove the display, you are cutting primarily through the foam layer.

The main tool is the display removal tool. The tool uses replaceable wheels (076-1417) that cut through the foam layer in the VHB strip. With careful use, these wheels can be reused five to ten times. When the wheel becomes nicked from contact with the chin, further use becomes difficult. Because of this, the tool should only be used along the top and sides of the display, and not along the chin. To remove the VHB strips along the chin, lower the display and pull the outer vertical tab on the strips.



Steps For Removal

Important: In the unlikely event that the display glass cracks or breaks, refer to [TP819: Cleaning and Handling a Broken Display Panel](#).

1. Use the service wedge to hold the display steady. When positioned correctly, the service wedge covers the power receptacle. Rotate the computer so the display panel is facing you.



2. Place a wheel on the removal tool by inserting the wheel into the notch on the handle. Push firmly until the wheel clicks into the notch. The tool cuts the foam core, which is located between two layers of VHB adhesive that secure the display panel to the rear housing.



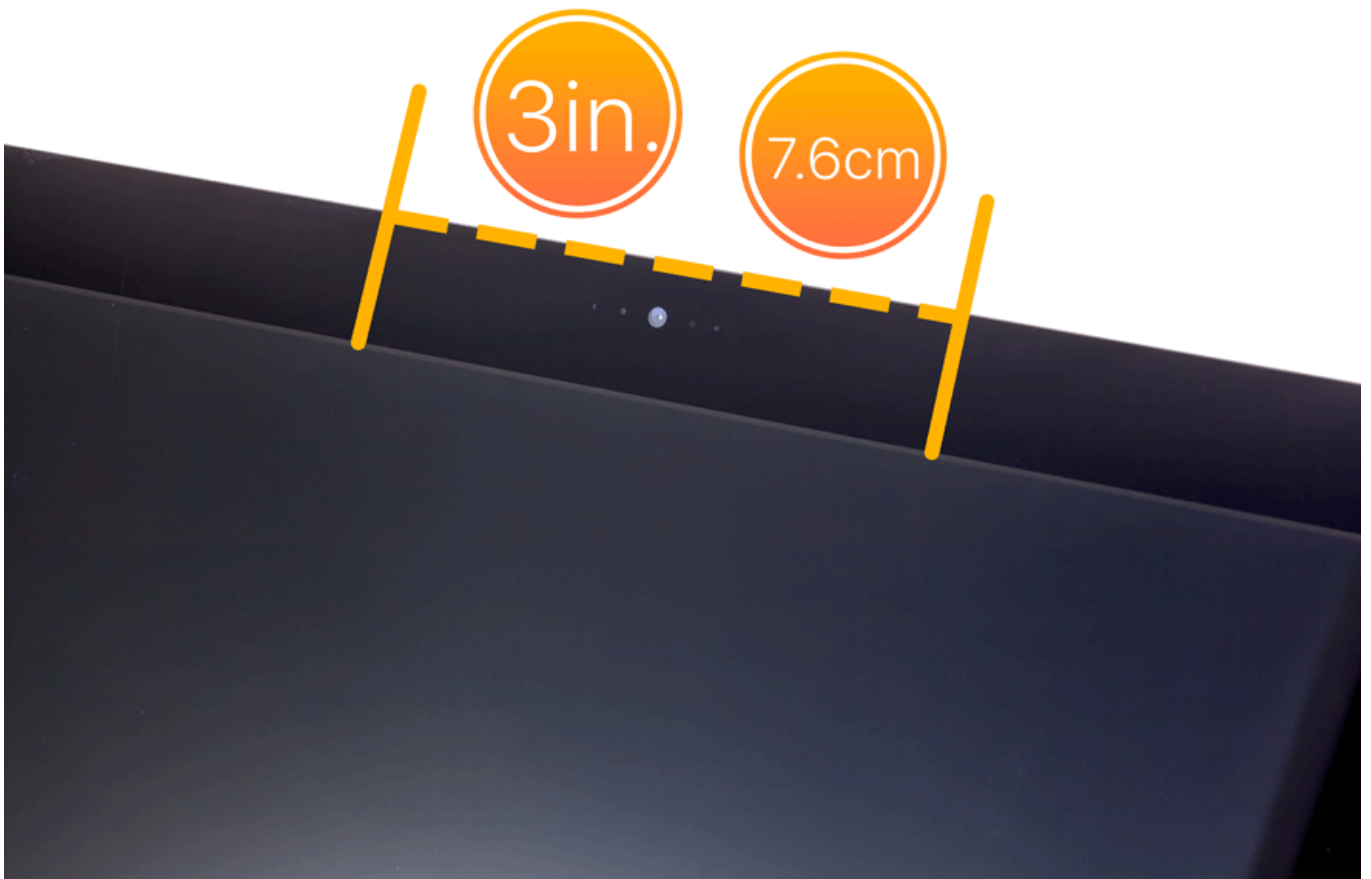
Caution: If the wheel becomes worn during use, then change the wheel. A worn wheel could permanently damage the black Mylar that is adhered to the edges on the back of the display panel glass.

3. Use only the display removal tool to cut through the foam layer of the VHB adhesive. Insert the display removal tool into the gap between the display panel and rear housing. Hold the display removal tool perpendicular to the edge of the computer.

Note: The tool should only be used along the top and sides of the display, not along the chin.



4. Avoid the top center edge of the display where the delicate microphone flex cables and camera are located. Allow a 3-inch (7.62-cm) protective zone here.



5. Roll the tool along the sides of the display panel. Move the tool back and forth until it moves with minimal resistance.





6. Pay special attention to the top corners, as the tool must make steady contact with the display and housing.



7. Use the flat end of a black stick to gently remove any visible VHB from the edges of the rear housing.

Caution: Forcing the black stick between the display panel and the rear housing may cause the display panel to fracture.



Caution: Pay special attention to the location of the Wi-Fi/Bluetooth antennas. **Do not pry** in these areas with the black stick.



8. Use the black stick and your fingers to carefully separate the display panel from the top of the rear housing. If there is resistance, then you need to remove more VHB material.



9. Tilt the display open slightly, just enough for your hand to reach the cables that connect the display to the logic board.

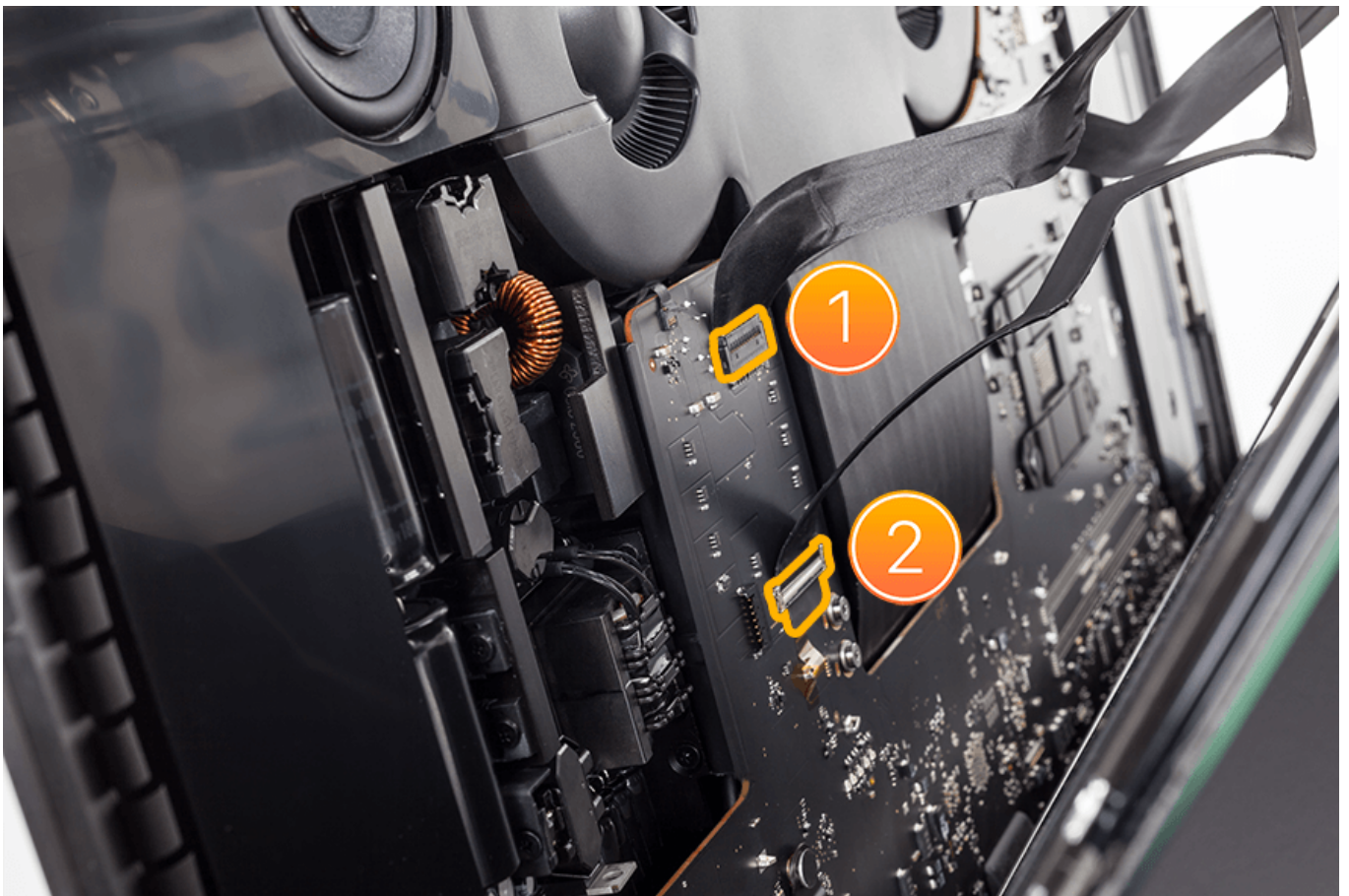
Caution: Be extremely careful not to stress the display cables and connectors on the logic board when tilting the display open. The display connectors on the logic board are easily damaged. If the connectors are damaged, then the logic board will need to be replaced.

Remember that the bottom edge of the display is still attached with VHB. **Do not** remove the display panel yet.



10. Carefully remove the Embedded DisplayPort (eDP) cable (2) from the logic board by moving the locking lever up and pulling the cable straight out of its connector. Disconnect the display backlight power cable (1) from the logic board by pinching the sides and pulling the power cable straight out of its connector.

Note: The display backlight power cable is part of the display panel assembly and is not a separate part.



11. Disconnect the camera cable from the logic board by lifting the locking lever and pulling the cable straight out of its connector.



12. Lower the display panel. Locate the two VHB strips along the chin. Pull the VHB tab on each strip toward the center.



13. Gently pull the display panel off of the rear housing and store it in an ESD-safe bag.

Caution: If the panel is sticking to the rear housing, then use a black stick to carefully break the VHB bond between the display and rear housing. Be careful not to damage the black Mylar on the display. If the black protective Mylar is pulled from the display, then the display panel may need to be replaced.



Steps For Reassembly

1. Remove the [display panel VHB strips](#).
2. Install new [display panel VHB strips](#).
3. Reinstall the [display panel](#).

Display Panel - Removing Very High Bond (VHB) Strips

First Steps

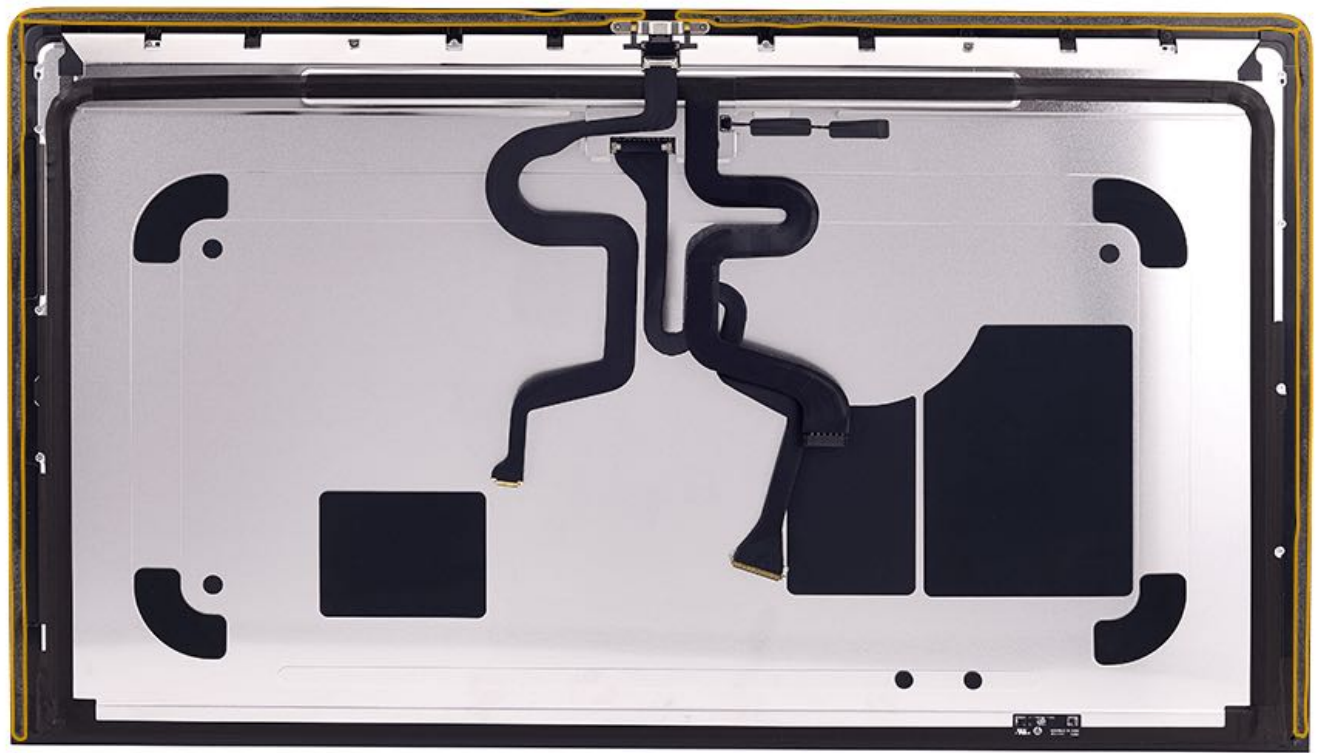
Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

Remove:

- [Display Panel](#)

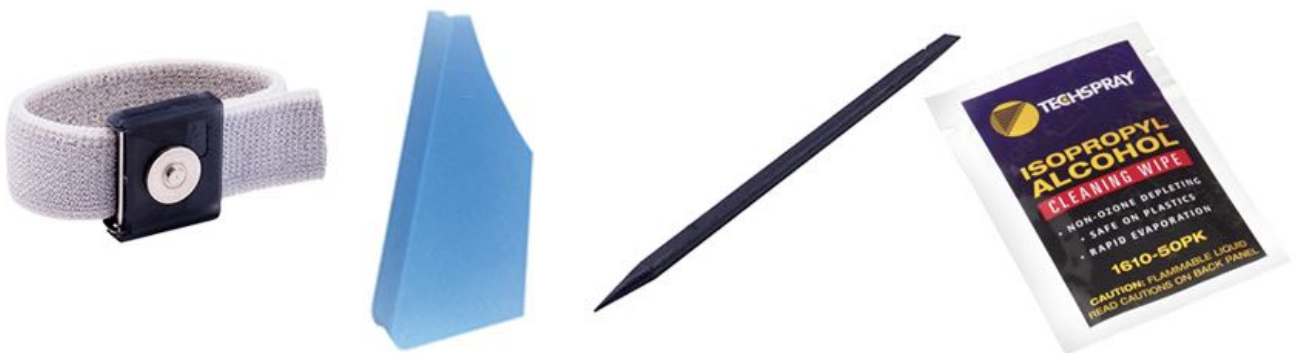
Note: These images are representative. It is possible for residual VHB to be located anywhere along the edges of the display and the enclosure.





Tools

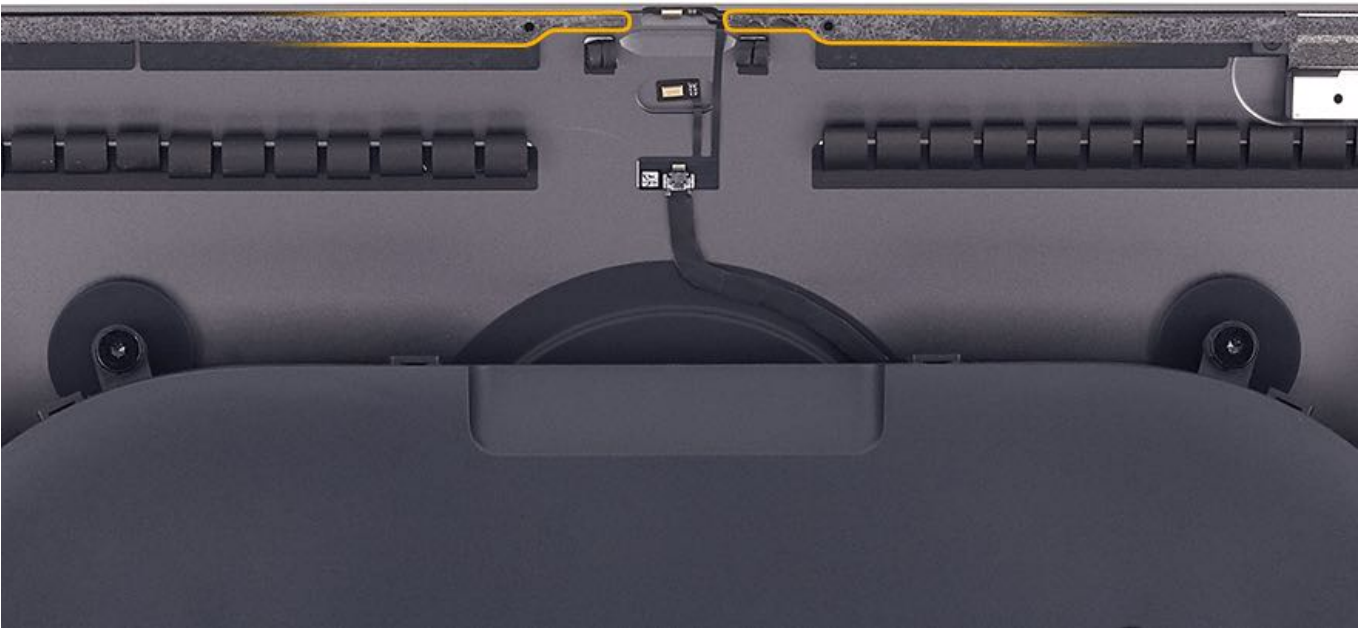
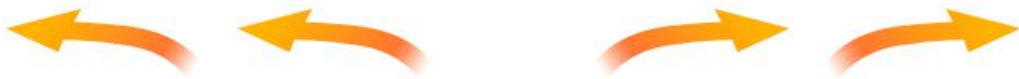
- ESD wrist strap and mat
- Service wedge (iMac)
- Black stick
- Isopropyl alcohol (IPA) wipes



Steps For Removal

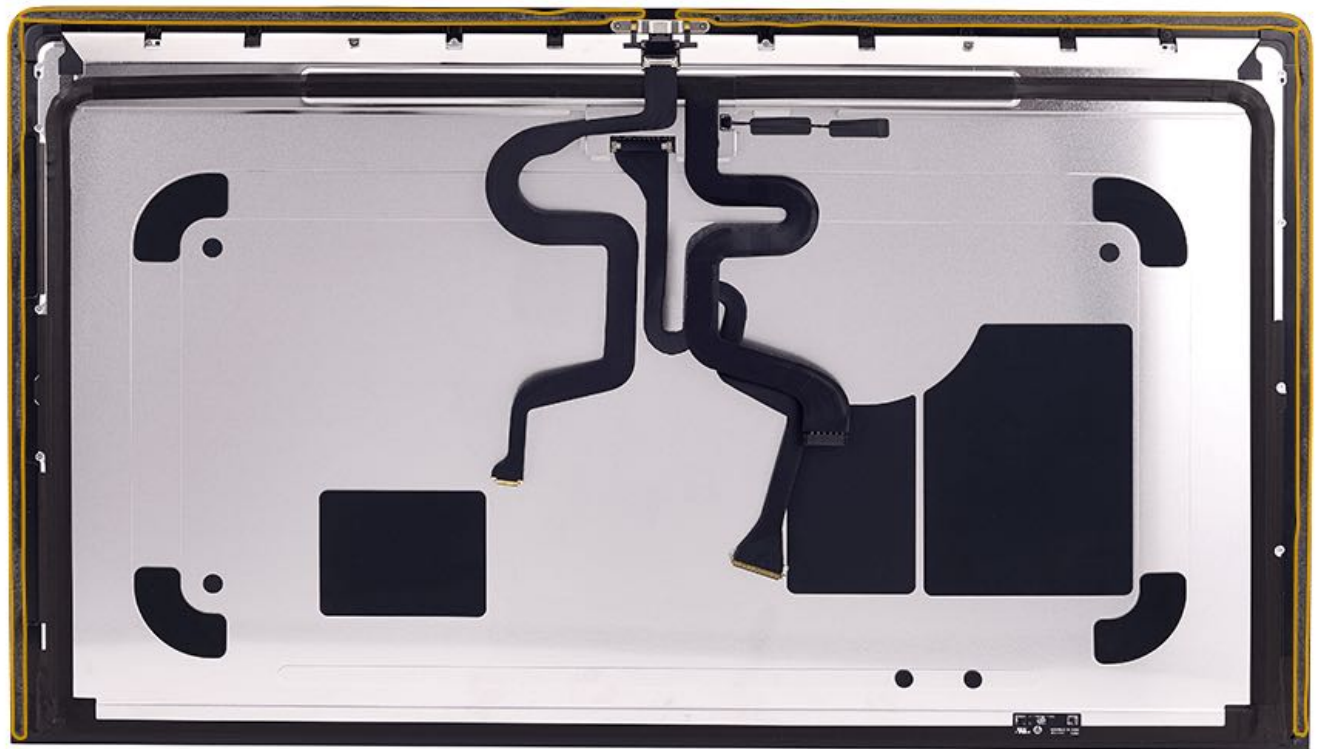
Note: On the rare occasion that the display glass cracks or breaks, refer to article [TP819: Cleaning and Handling a Broken Display Panel](#).

1. Use your fingers and the flat end of a black stick to remove any residual very high bond (VHB) adhesive that is left on the rear housing.



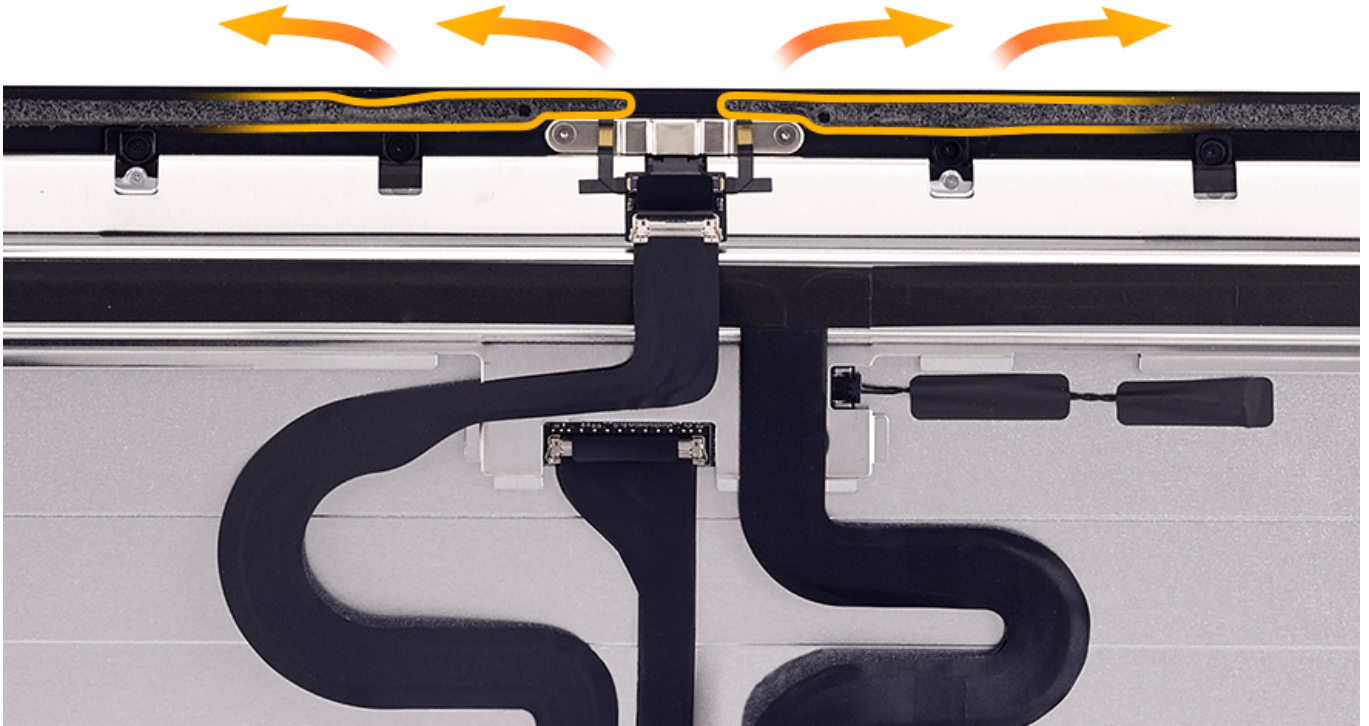


2. Peel the VHB from the display panel.



Note: Be careful when removing VHB from the display panel. To prevent damage to the black Mylar protective film that is located on the display panel glass, ensure you are peeling up the VHB and **not** the Mylar film. An easy way to ensure that you do not peel up the Mylar film on the display is to start peeling the VHB from the center points, not from the corners of the display.

- Top of display shown. Peel VHB to the left and right, above the camera module location.
- At the bottom corners of the display, peel the VHB upward.



Note: If the black protective Mylar film is peeled or wrinkled on the display, then press the film back onto the panel with your finger. The Mylar should be smooth and undamaged. Use caution when working around the black Mylar protective film. If the Mylar is pulled from the display, then the display panel may need to be replaced.

3. Do not peel VHB from the display corners. The chance of damaging the black Mylar protective film is greater if VHB removal is started in the corner.



4. Remove any remaining adhesive by wiping the rear housing and display panel edges clean with an IPA wipe. Continue until the surfaces no longer show VHB residue.

Caution: Do not use IPA wipes on the display. IPA wipes should only be used to remove residual VHB adhesive. Be careful not to get IPA wipes on the display while removing the VHB residue.

5. Allow the surfaces to dry for one minute.
6. Check again to ensure the display and rear housing are clean of VHB.

Steps For Reassembly

1. Install new [display panel VHB strips](#).
2. Reinstall the [display panel](#).

Display Panel - Replacing Very High Bond (VHB) Strips

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)



Tools

- ESD wrist strap and mat
- Service wedge (iMac)
- Black stick
- Display Refill Kit, VHB strips, 6-piece set, 20-pack (076-00375)



Steps For Removal

This is a reassembly instruction article. For removal steps, see article [RP1404: Display Panel - Removing Very High Bond \(VHB\) Strips](#).

Steps For Reassembly

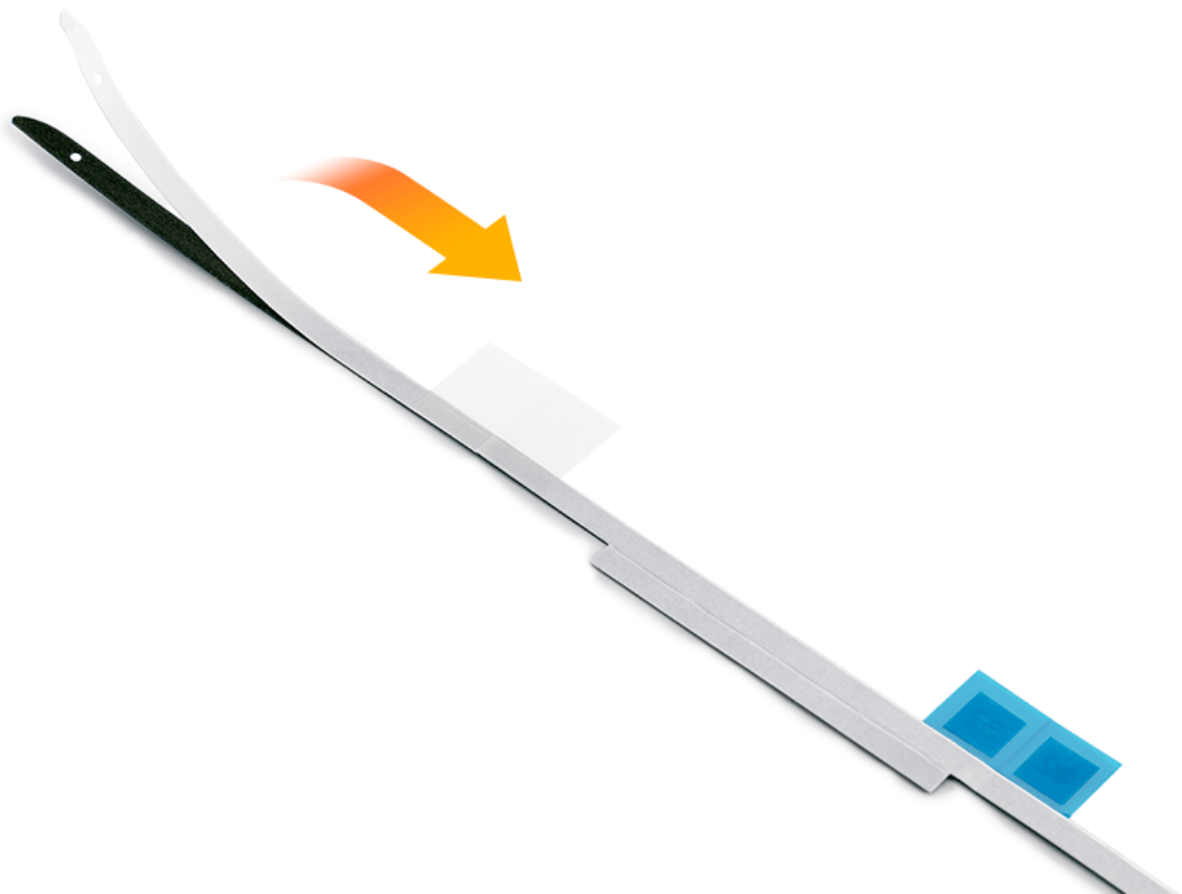
1. Each VHB strip has an ID number on the pull tab and part number (946-xxxx) printed on the strip. Use the table and pictures below to verify that you have all of the needed VHB strips. Lay out the VHB strips before installing them onto the computer and check them for damage. Check that there are no wrinkles or exposed sections on the strip. Damage can cause cosmetic gap issues, make the display bond weak, or create light leakage.

VHB Strip Description	VHB Strip ID Number	Part Number on VHB Strip
Top left	33	946-0943
Top right	32	946-0942
Right side	21	946-03774
Bottom right	14	946-4551
Bottom left	15	946-4550
Left side	16	946-4552



2. The VHB strips have a foam layer (VHB/foam/VHB), with a removable liner on the underside and a clear plastic liner on the top side. Use the plastic pull tab to peel the paper liner from the underside of the VHB strip.

Note: The color of the removable liner may vary between VHB vendors.



3. The rear housing has eight alignment holes. Use them to align the new VHB strips.

Important: Before adhering the VHB strips and installing the display, verify that all cables are connected, all screws are installed, and that there is no debris present in the computer.



4. Peel the paper off of the back of the VHB strips.

5. Use the pointed end of a black stick to align the VHB strips on the rear housing. **Note:** The paper liner side faces the rear housing.

6. As you position the VHB, use your finger to peel the remaining paper liner from the underside of the VHB strip.

7. Use your finger to press the VHB strip into place on the rear housing. **Note:** If a VHB strip does not line up correctly, remove it and start again.

8. Do not remove the clear plastic liners from the top layer of the strip at this time. Remove them right before you replace the panel.



9. Repeat the VHB process (align, peel paper liners, press VHB into place) along the top edge of the rear housing. Press with your fingers to adhere the strips to the rear housing.



10. Two strips of VHB are used along the bottom edge. There are no guide holes on the VHB strip or rear housing for the bottom strips. Align the strips carefully by hand.



11. **Note:** If any VHB strip does not line up correctly, then remove it, clean the rear housing, and start again. Check that there are no wrinkles or exposed sections on the strip. Damage can cause cosmetic gap issues and may make the display bond weaker or create light leakage.

12. To install the display panel, refer to [RP1406: Display Panel Reassembly](#).

Display Panel Reassembly

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

For video instruction, refer to article [SV364: Display Panel Replacement Video](#).

Replace:

- [Display Panel VHB Strips](#)



Tools

- Service wedge (iMac)
- Isopropyl alcohol (IPA) wipes (to remove residual VHB adhesive)
- Safety glasses
- Painter's tape (tape that does not leave a residue, 1 to 2 inches wide, preferably 2 inches, if available)
- Silicone display roller
- Clean, damp, lint-free cloth (to clean display panel glass)



Steps For Removal

This is a reassembly instruction article. Before you begin, refer to the following articles:

- [RP1403: Display Panel Removal](#)
- [RP1404: Display Panel - Removing Very High Bond \(VHB\) Strips](#)
- [RP1406: Display Panel - Replacing Very High Bond \(VHB\) Strips](#)

If you have already performed the removal and replacement tasks listed above, then proceed to the next step.

Steps For Reassembly

Important: In the unlikely event that the display glass cracks or breaks, refer to article [TP819: Cleaning and Handling a Broken Display Panel](#).

1. Insert the service wedge to hold the display steady for this procedure. When positioned correctly, the wedge covers the power receptacle.



2. Before installing, ensure that any residual VHB is removed from the display panel and rear housing.

3. Place the display panel on the chin of the rear housing. Align the panel and check that it is centered and seated.



4. Use the display removal tool to check the alignment on both sides of the display. Adjust if necessary.

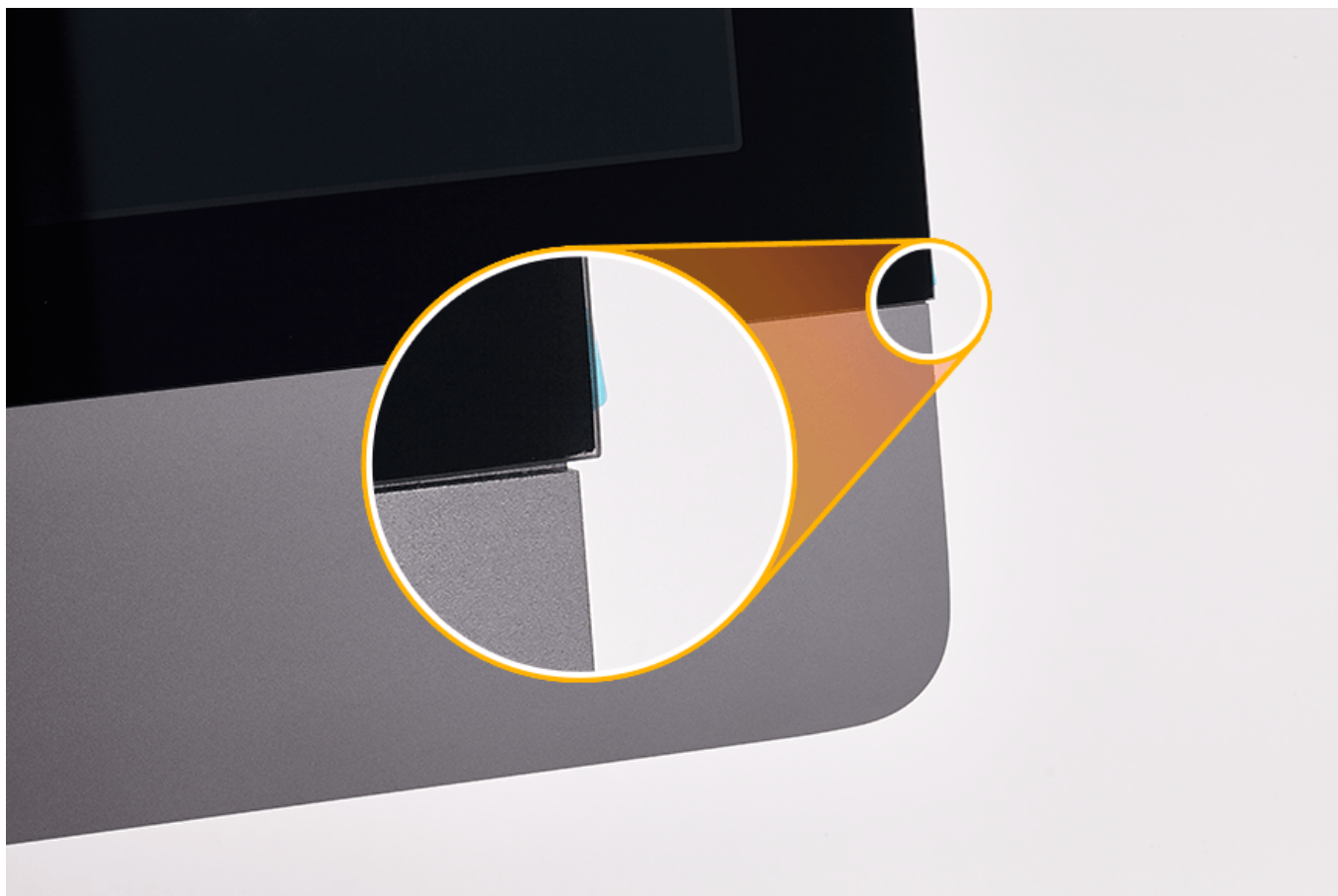


5. Anchor the display with a strip of painter's tape. Place it over the bottom of the display and the edge of the rear housing.

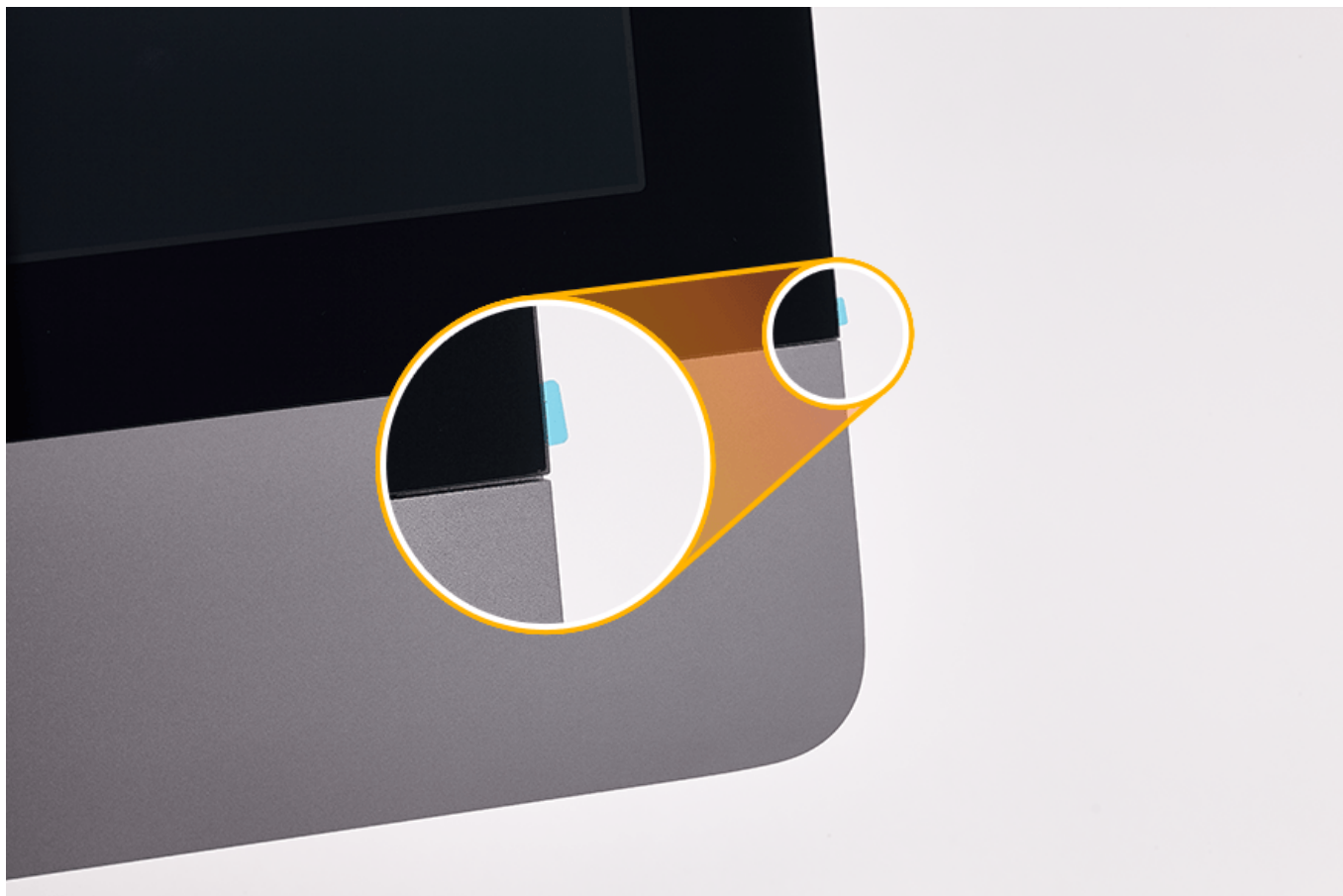


6. Stand back to check the alignment of the display panel. If the rear housing can be seen, then adjust the panel and check again.

Incorrect alignment



Correct alignment



7. Anchor the display further with more strips of painter's tape. Place one or two vertical pieces along the edge for added support.



8. Use one hand to tilt the display while steadying it with the other hand.



9. While continuing to steady the display with one hand, use the other hand to pull the clear release liners on the bottom VHB strips. Pull the release liners carefully so they do not tear or break.



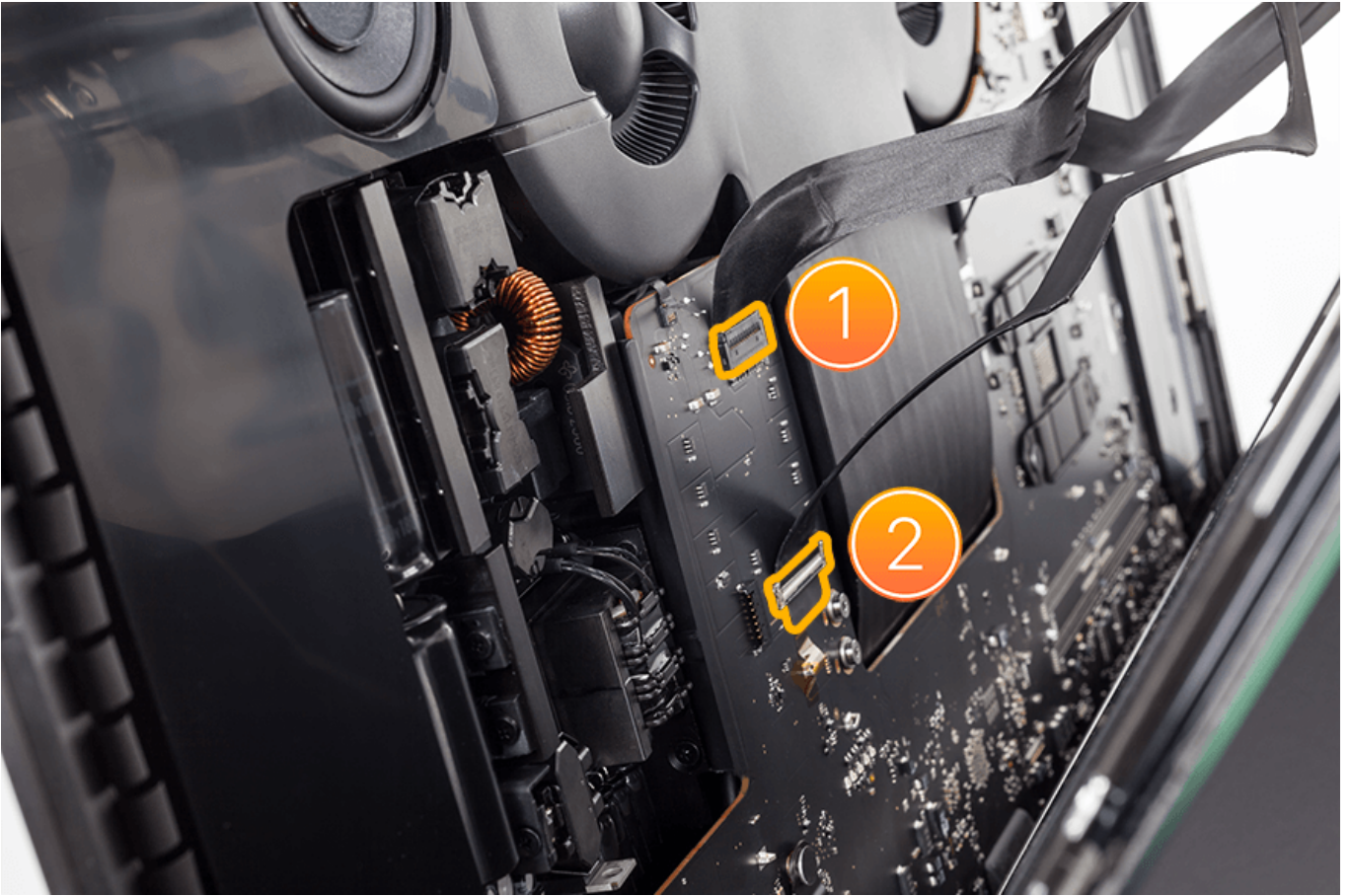
10. Remove the remaining release liners from the top and sides of the display panel.



11. Tilt the display up, leaving enough room to connect the Embedded DisplayPort (eDP) (2) and display backlight power (1) cables to the logic board. If the eDP cable is not connected properly, it could result in no video or no power. If the camera cable is not connected properly, it could result in the no camera or the camera not working properly. Check that the connectors are firmly seated.

Important: Be extremely careful not to stress the display cables and connectors on the logic board when tilting the display open. The display connectors on the logic board are easily damaged. If the connectors are damaged, then the logic board will need to be replaced.

Note: The display backlight power cable is part of the display panel assembly and is not a separate part.



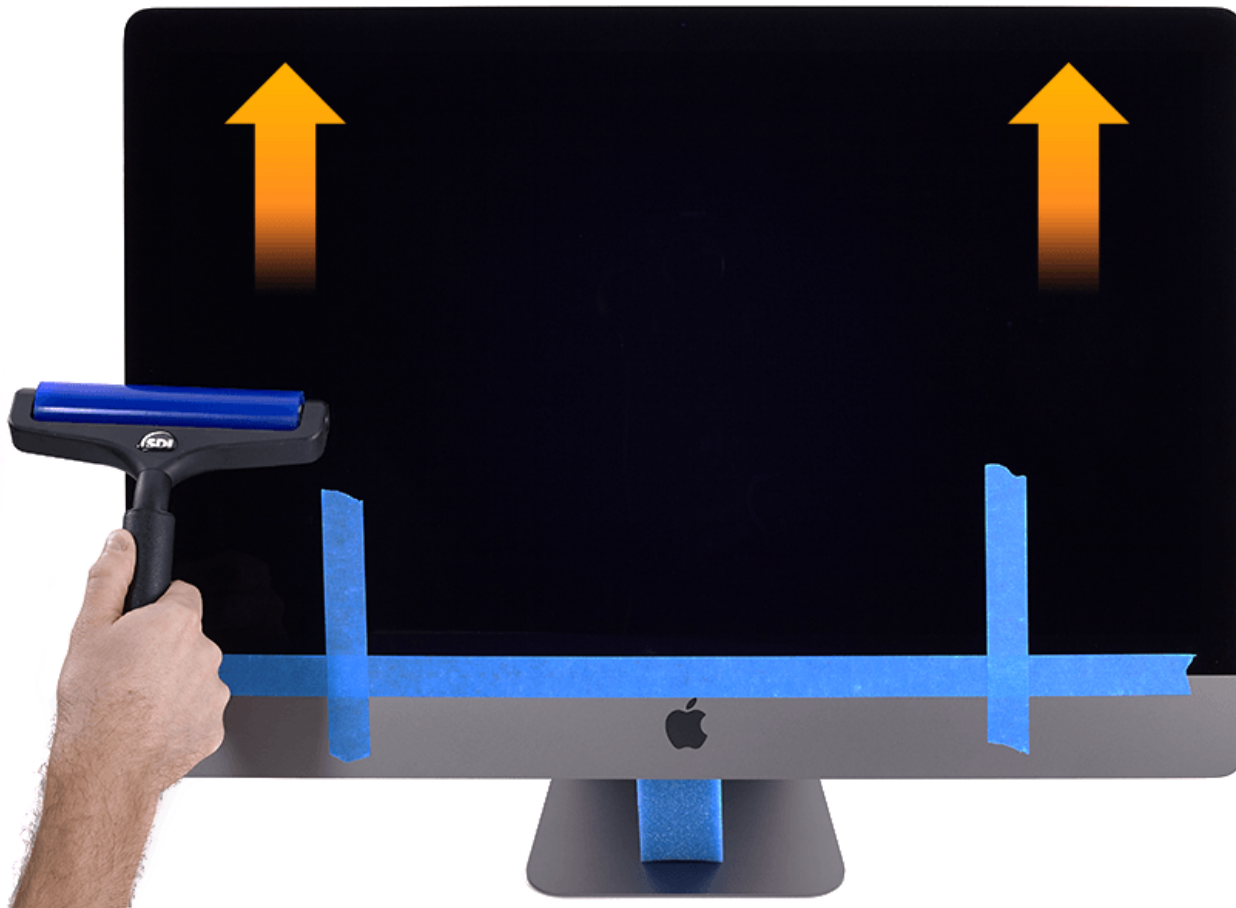
12. Connect the camera cable to the logic board.



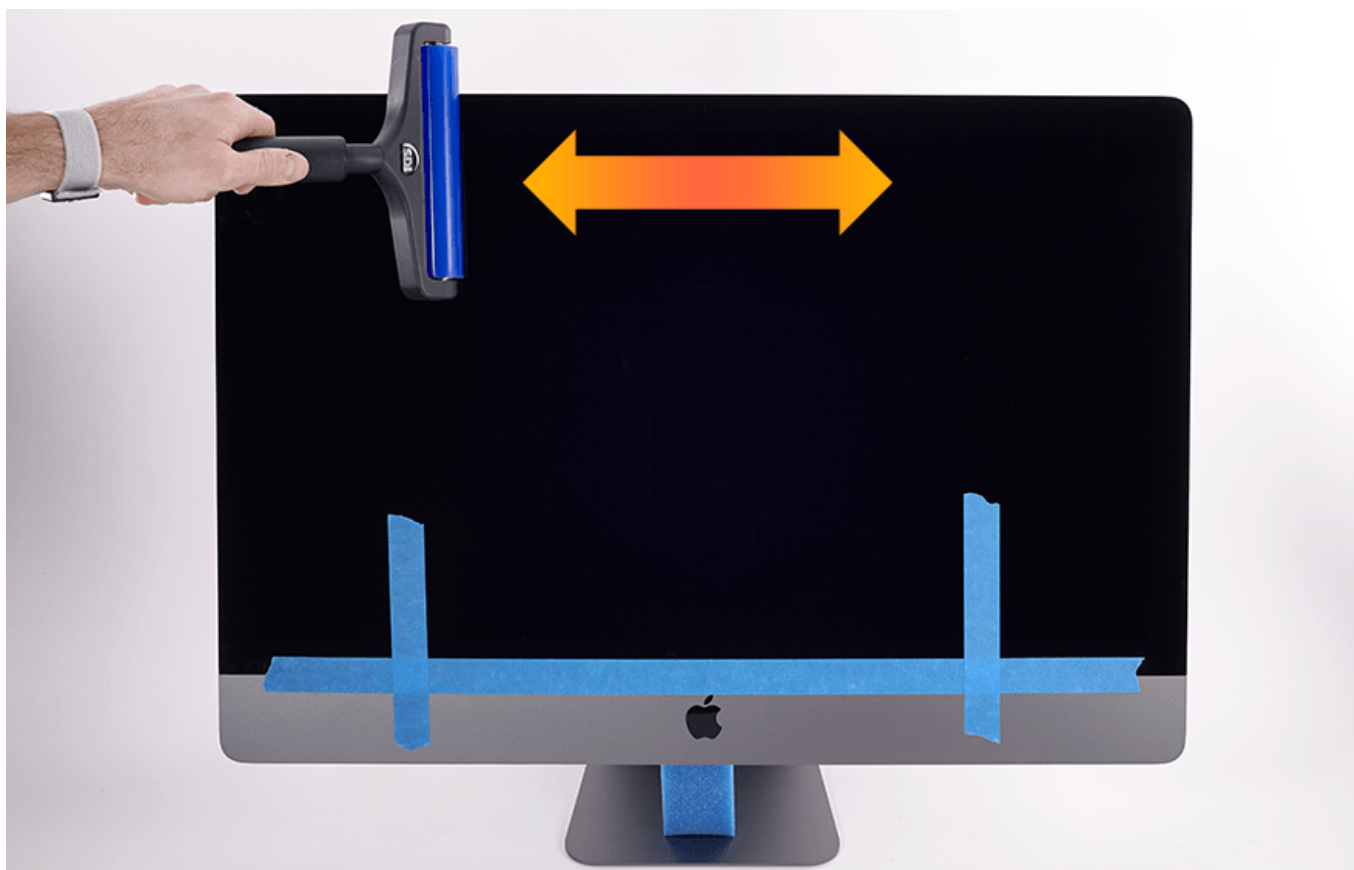
13. After all the release liners have been removed, lower the display panel against the rear housing.

14. Use the silicone display roller to adhere the VHB strips to the glass. To prevent image quality issues the roller should

only apply pressure while moving from the bottom to the top. Do not repeatedly roll up and down.



Repeat the rolling along the top and the other side.



15. Clean the front of the display with a clean, damp, lint-free cloth.

Note: Do not use IPA wipes to clean the display. IPA wipes should only be used to remove residual VHB adhesive.

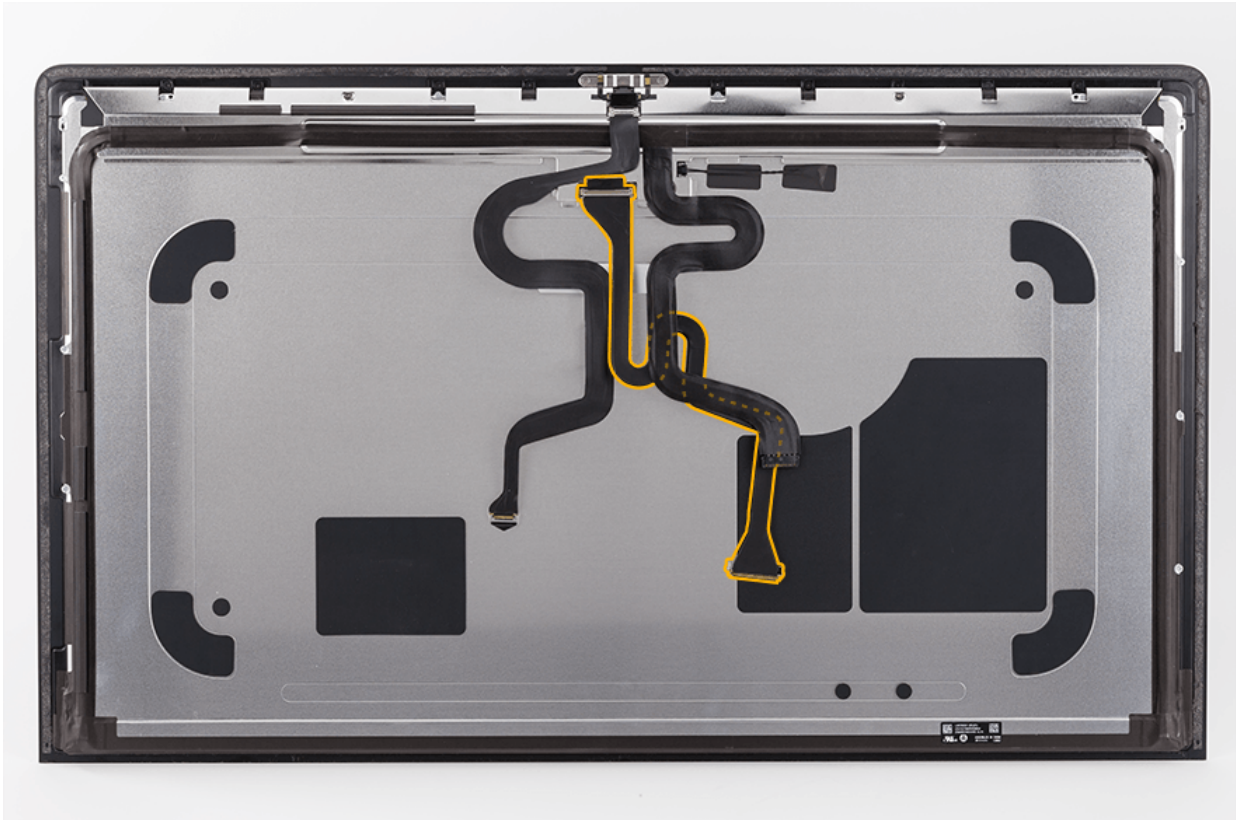
Embedded DisplayPort (eDP) Cable

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)



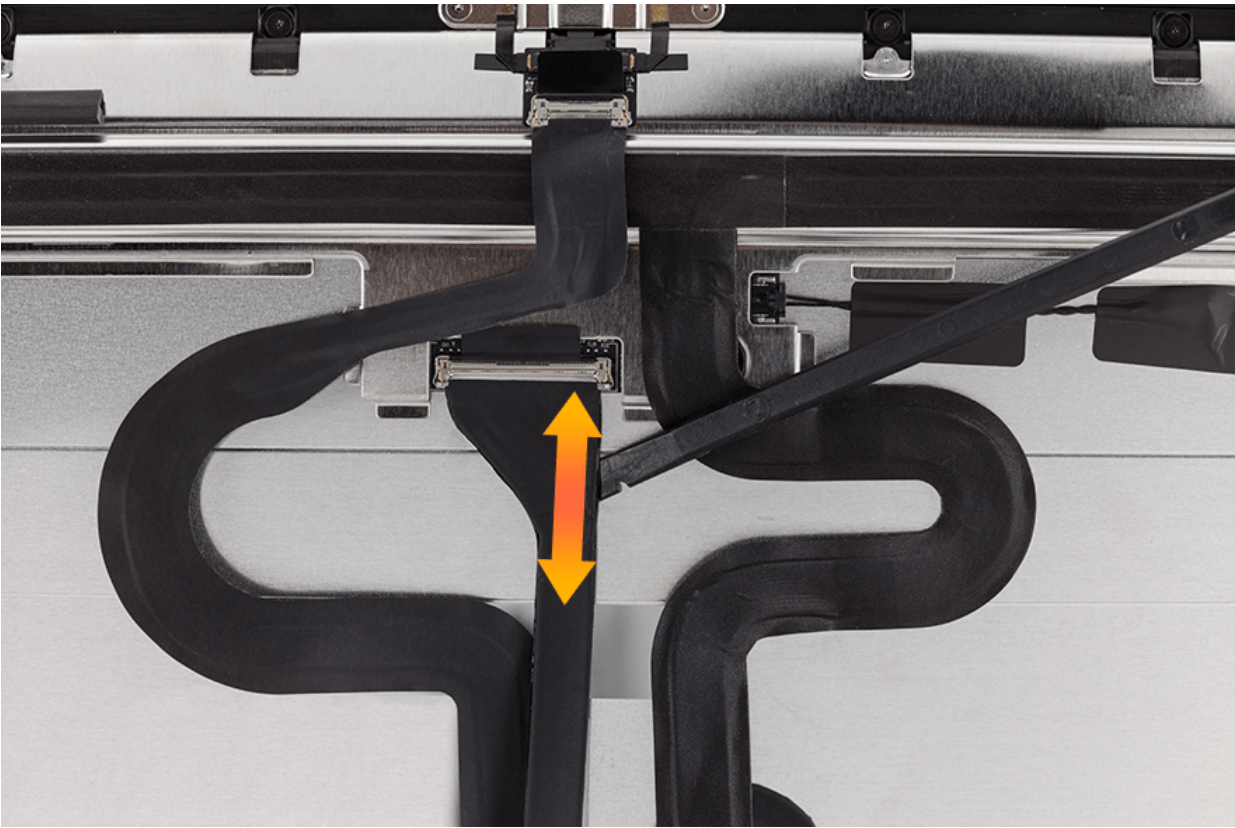
Tools

- ESD wrist strap
- Black stick

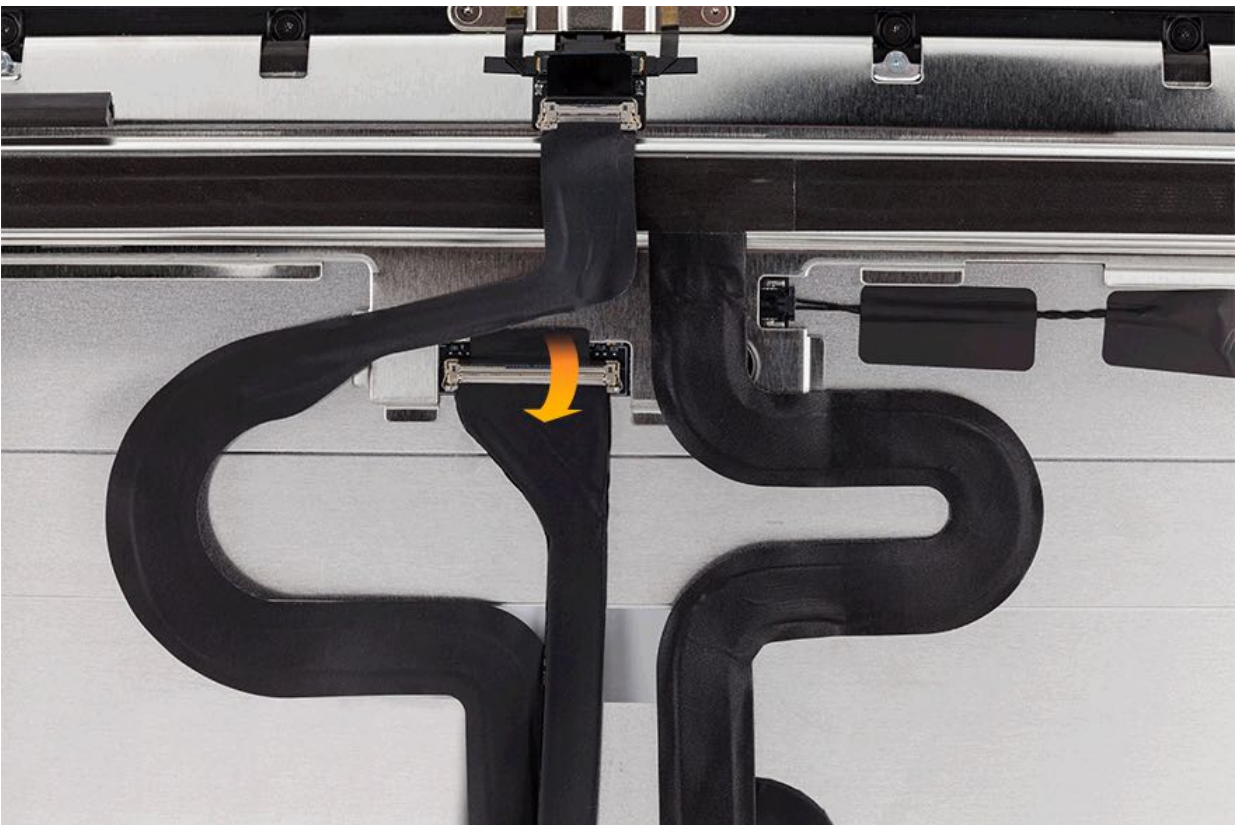


Steps For Removal

1. Remove any tape that secures the Embedded DisplayPort (eDP) cable to the display panel.



2. Use a black stick or a finger to “unlock” the lock bar by gently flipping the bar toward the eDP cable.



3. Gently pull the eDP cable out of the connector.

Steps For Reassembly

1. Remove the pull tab on the back of the cable to expose the adhesive before inserting the cable into the display panel connector.
2. Insert the eDP cable into its connector. Flip the lock bar up, ensuring that the cable is securely connected.

Important: Press down around the lock bar to lock the lever into place.

Note: Press on the area of the cable with the adhesive, to secure the cable to the display panel.

3. Install new [display panel VHB strips](#).

4. Reinstall the [display panel](#).

Rear Mic Cable

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

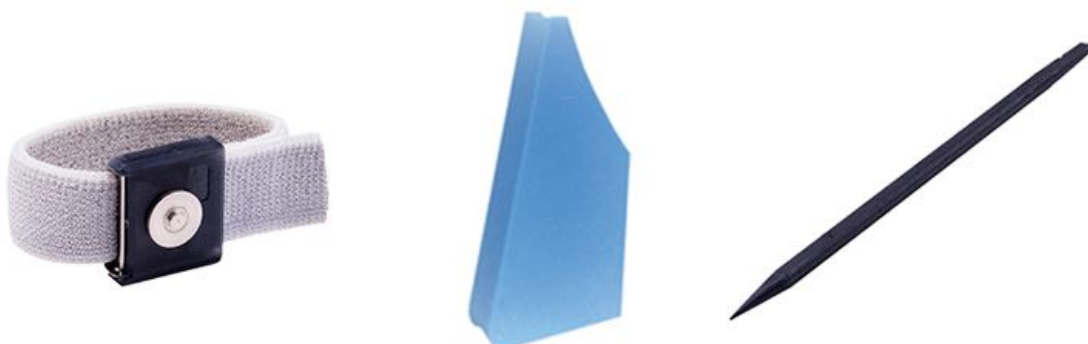
Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)
- [Dual Fan Assembly](#)



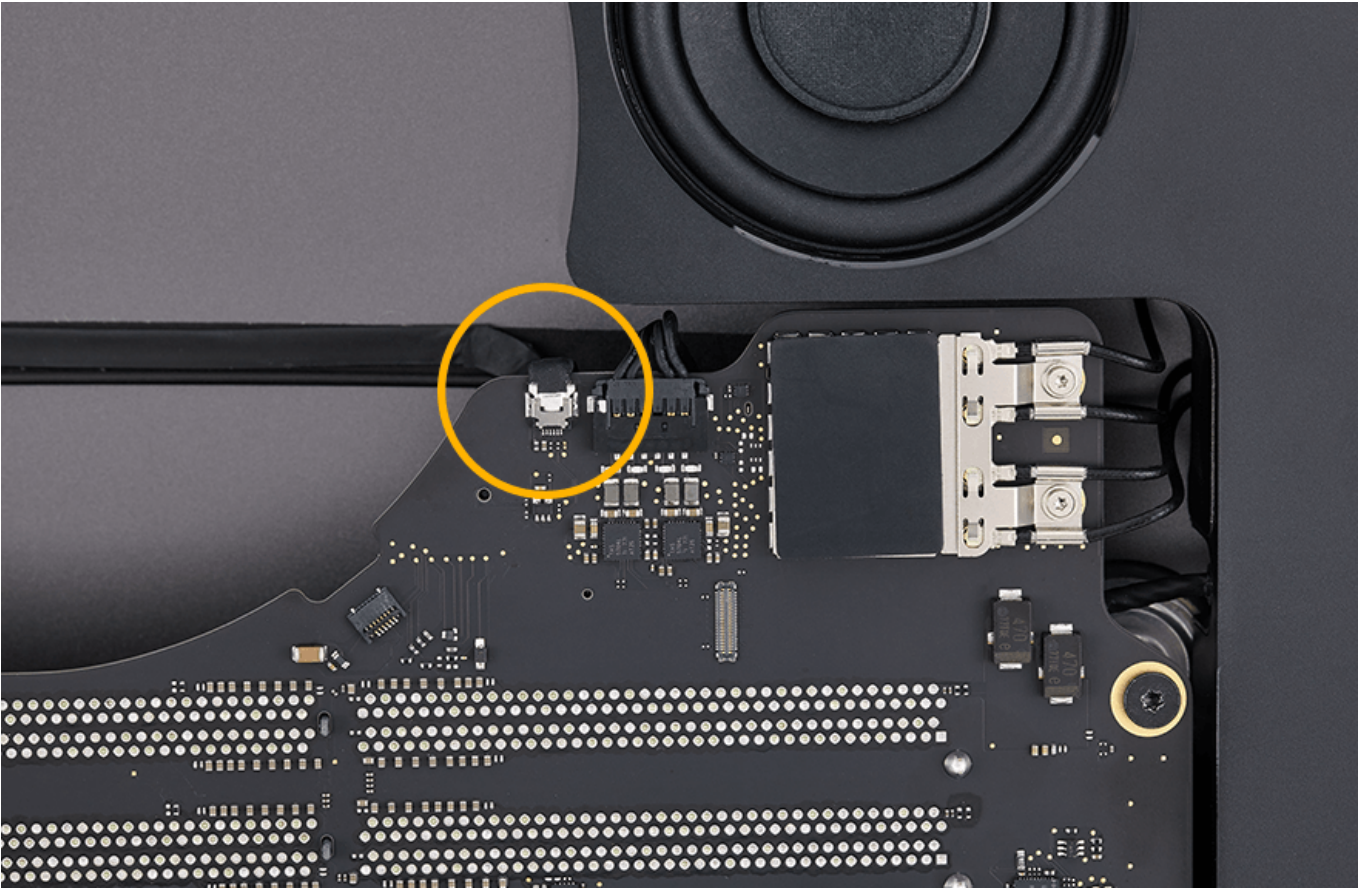
Tools

- ESD wrist strap
- Service wedge (iMac)
- Black stick



Steps For Removal

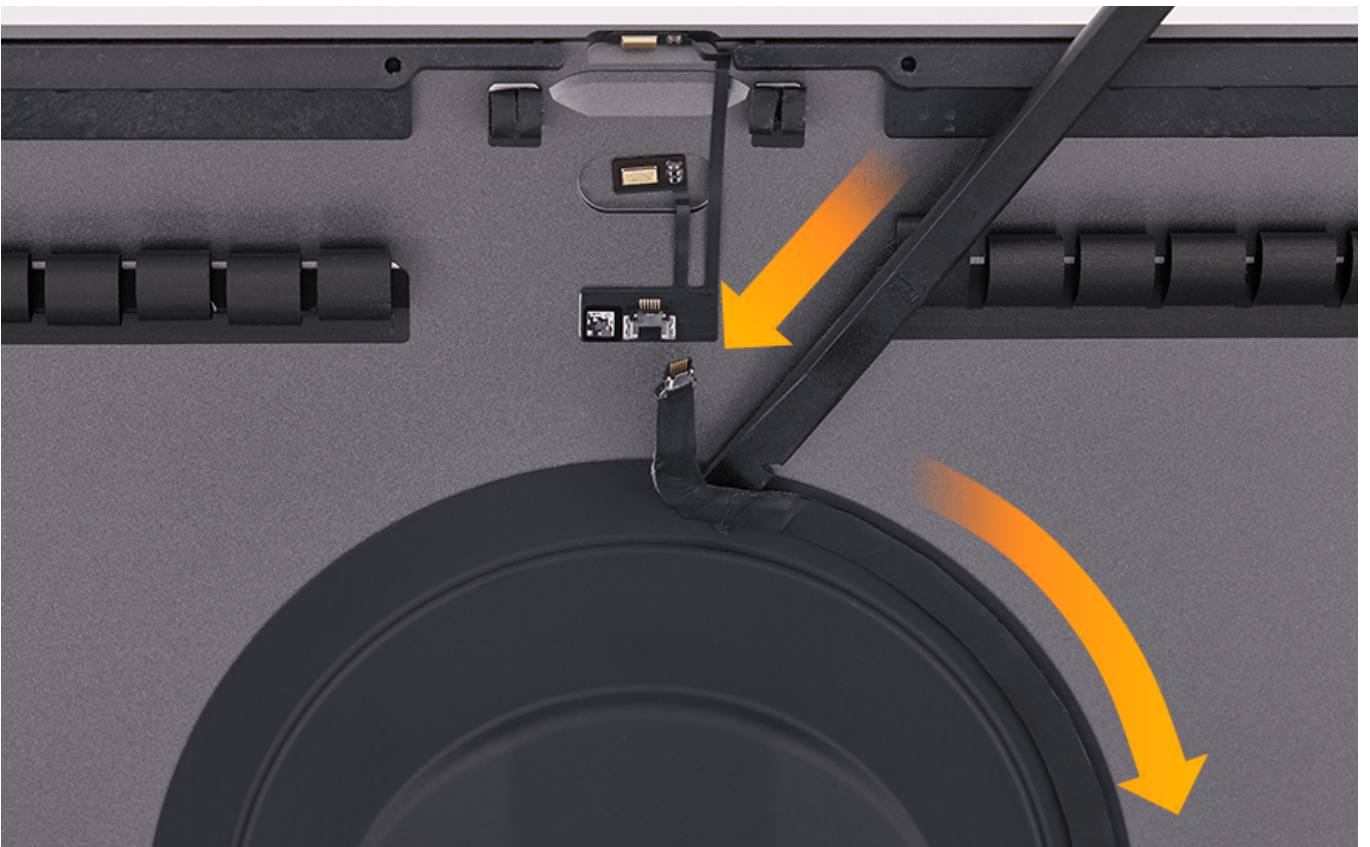
1. With fingers or a black stick, disconnect one end of the flex cable from the logic board.



2. With fingers or a black stick, disconnect the other end from the enclosure.

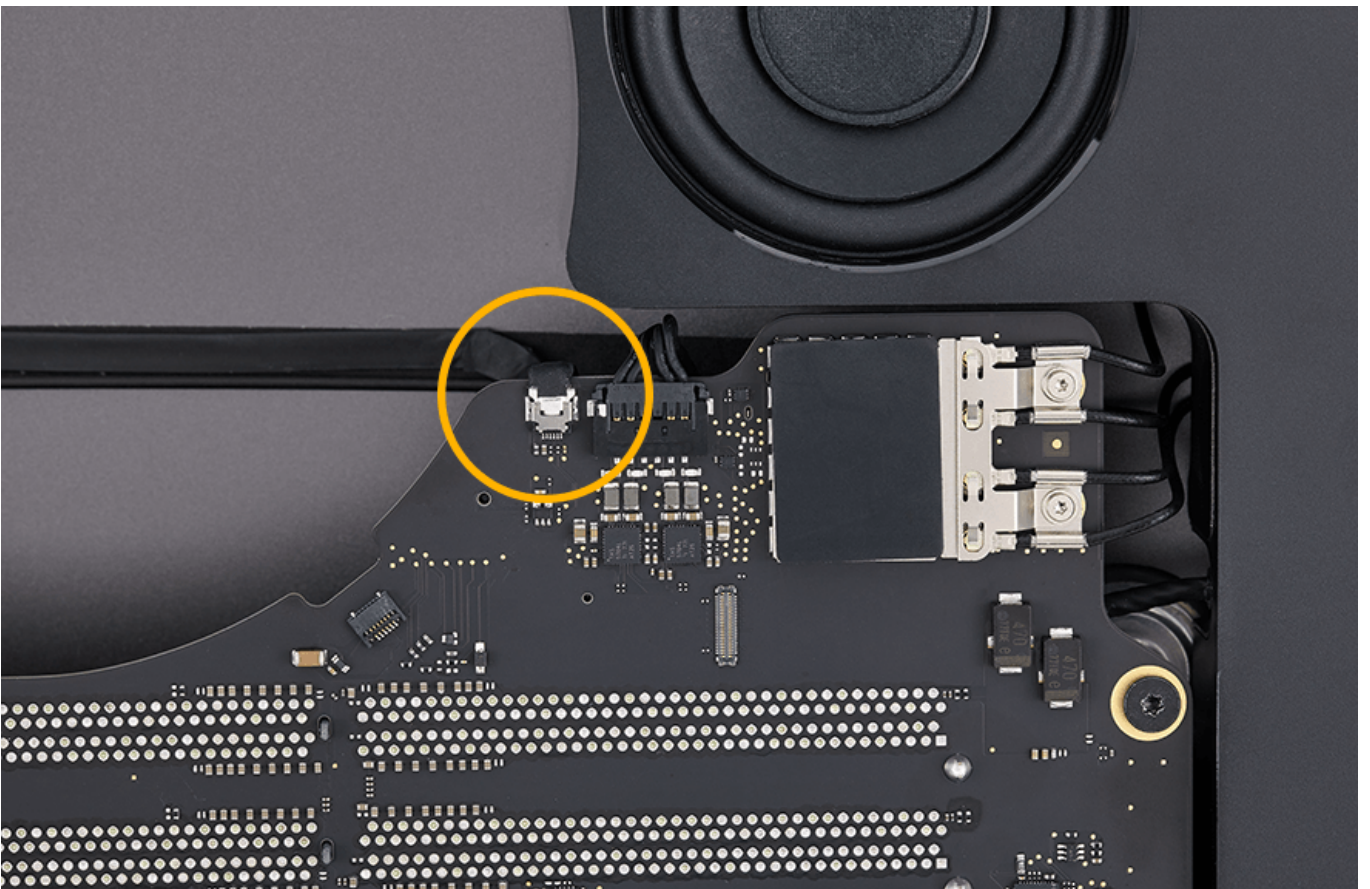


3. With a black stick, gently loosen the adhesive to peel the cable from the enclosure.



Steps For Reassembly

1. Reconnect one end of the cable to the logic board.



2. With a black stick, gently press the cable down into the enclosure to reattach adhesive.
3. Reconnect the cable to the enclosure.



4. Reinstall the [dual fan assembly](#).
5. Install new [display panel VHB strips](#).
6. Reinstall the [display panel](#).

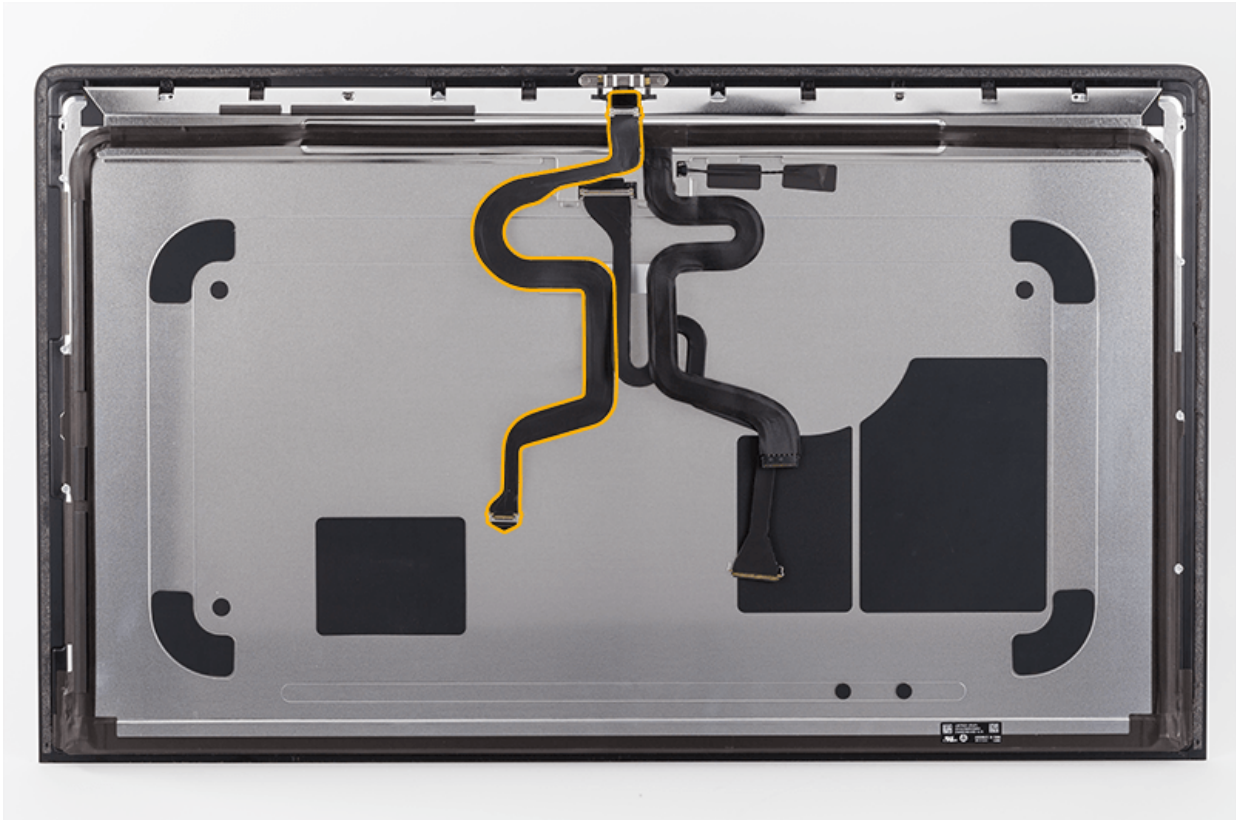
Camera Cable

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)



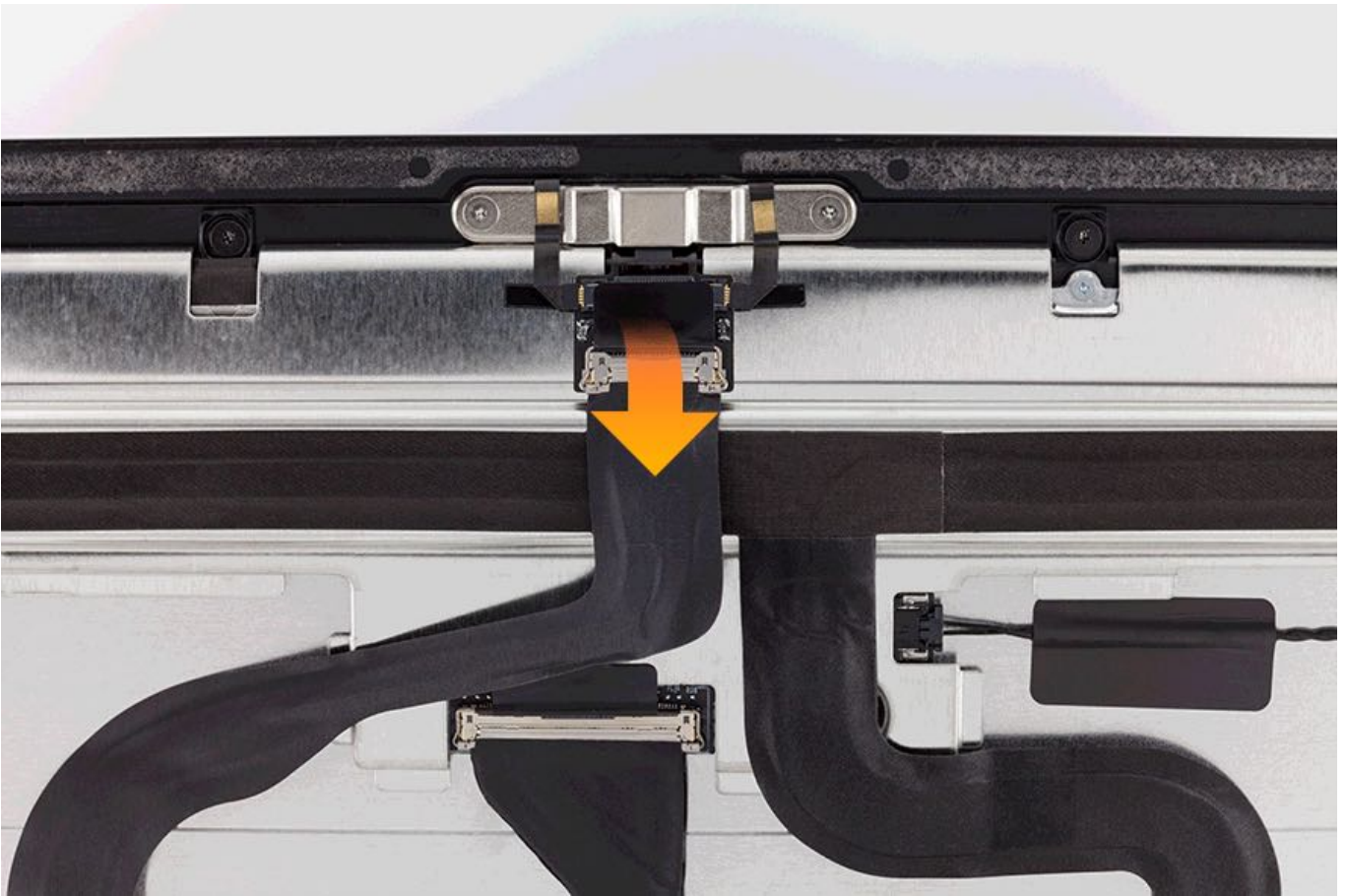
Tools

- ESD wrist strap
- Service wedge (iMac)
- Black stick

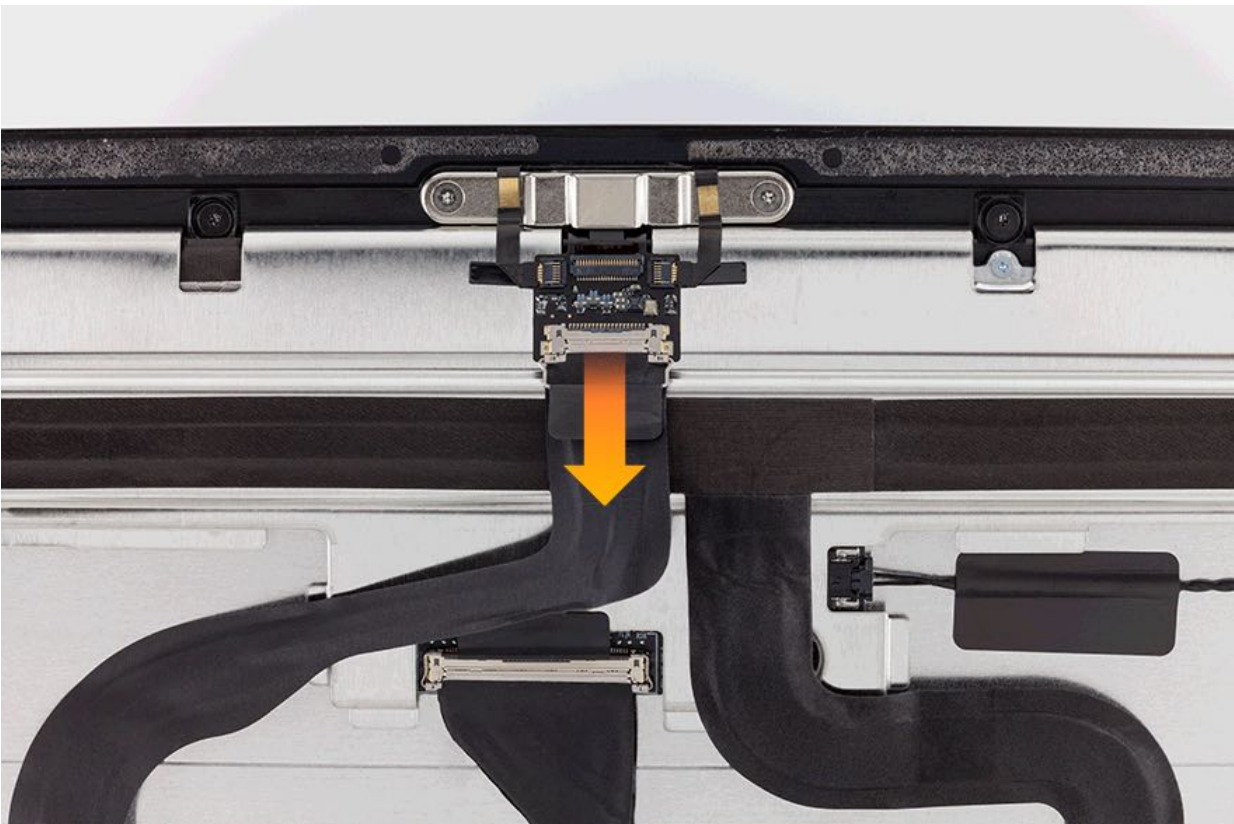


Steps For Removal

1. Use a black stick to flip up the lock bar toward the cable.



2. Gently pull the cable, not the lock bar, to disconnect the cable.



Steps For Reassembly

1. Reconnect the camera cable. Flip the lock bar up and check that it is secure.
2. Install new [display panel VHB strips](#).
3. Reinstall the [display panel](#).

Dual Fan Assembly

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

For video instruction, refer to article [SV365: Dual Fan Assembly Replacement Video](#).

Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)



Tools

- ESD wrist strap
- Torx T10 screwdriver (magnetized)
- Black stick
- Service wedge (iMac)

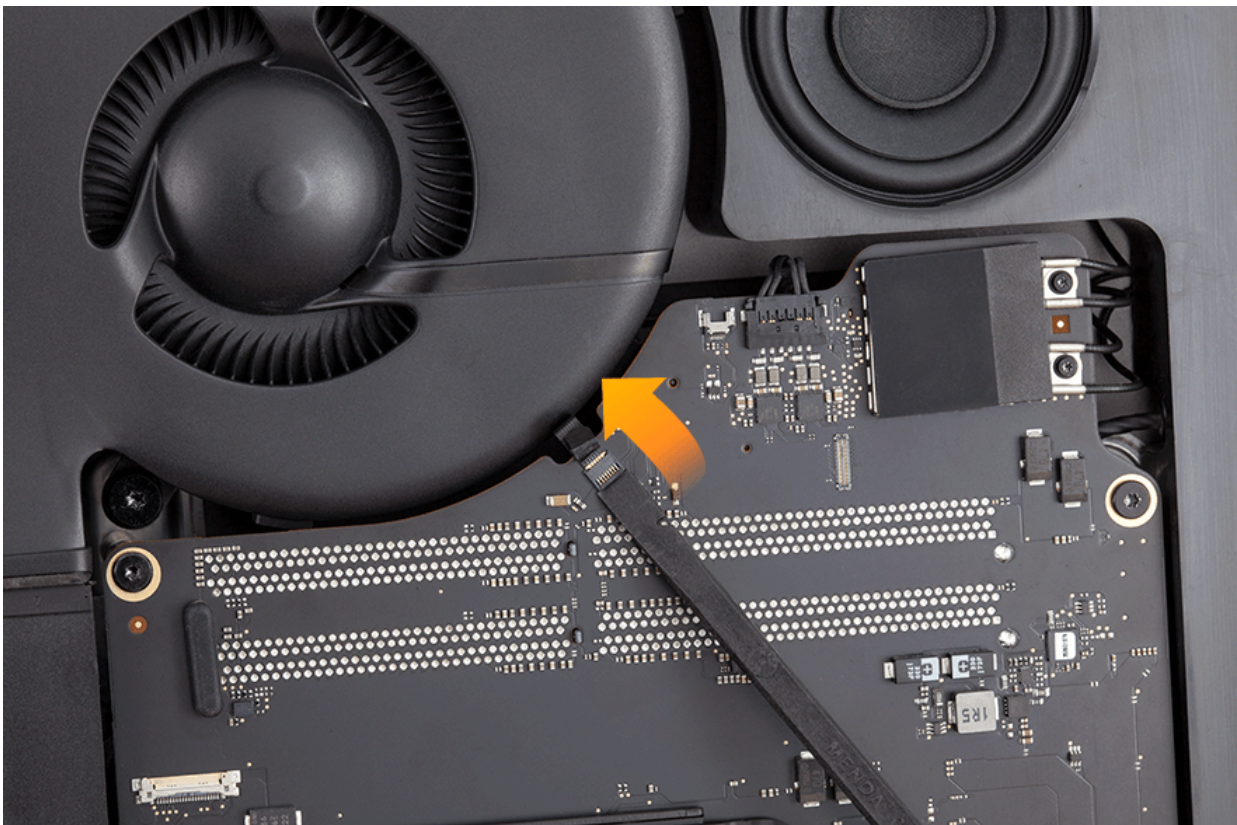


Steps For Removal

1. Gently lift the Mylar tabs from the right and left fan cables where they connect to the logic board.



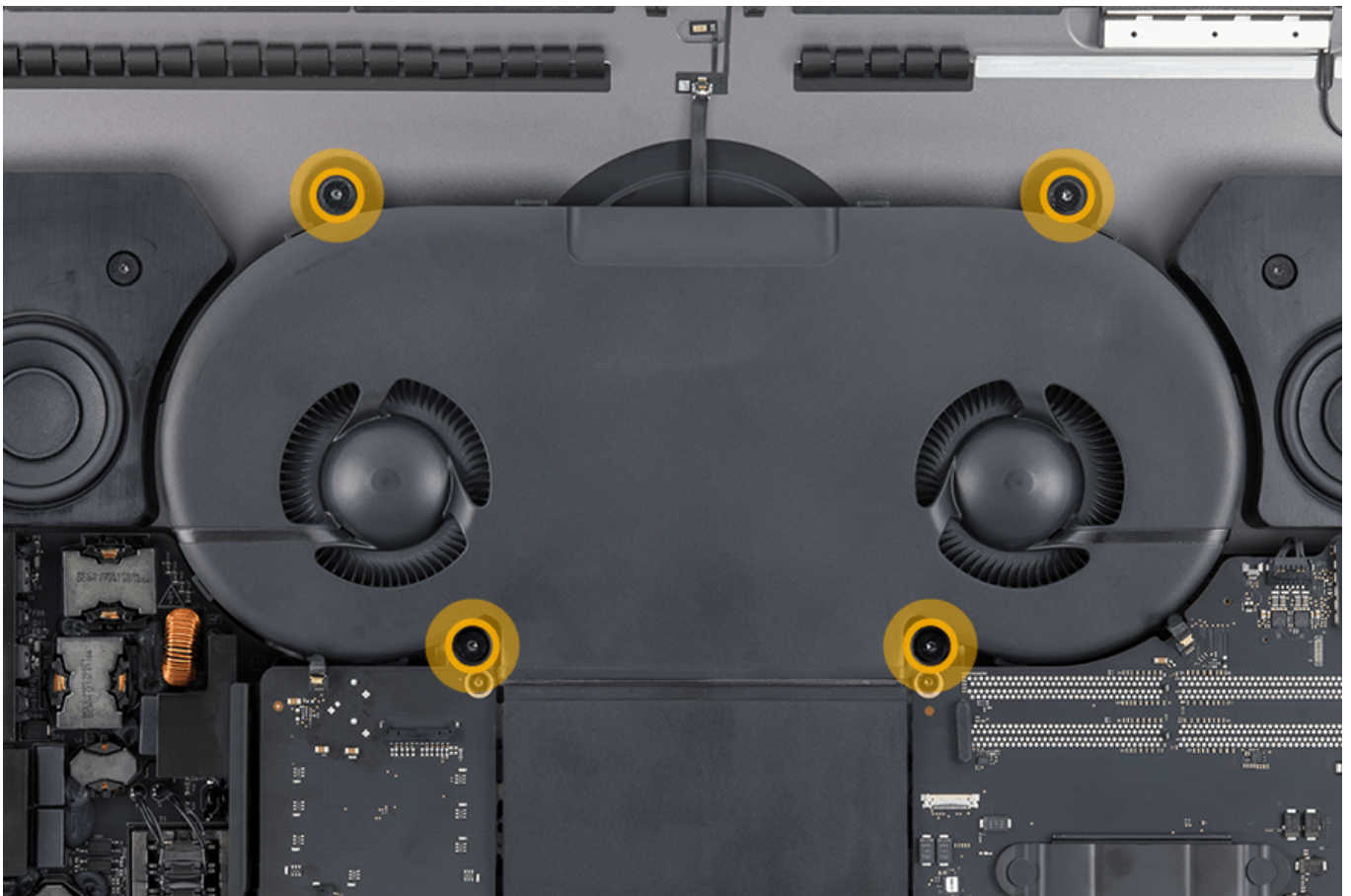
2. With a black stick, flip open the locking lever and holding the flex cable, not the tabs, disconnect both flex cables.



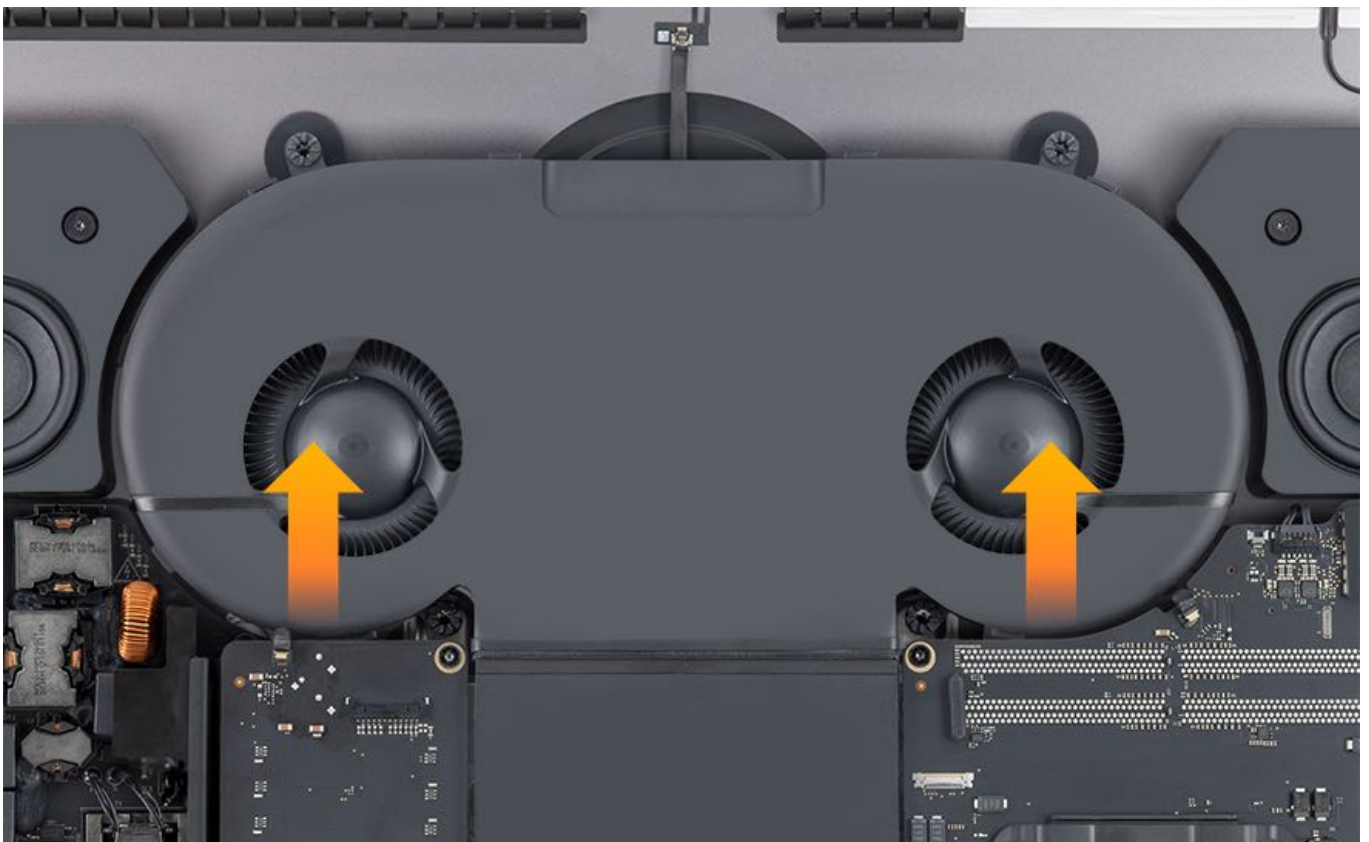
3. Starting with the bottom screws, loosen the four T10 screws from the dual fan assembly.

- T10: 923-00669





4. Using two hands, tilt the dual fan assembly and lift it out.



Steps For Reassembly

Note: If the standoffs came off of the enclosure when the dual fan assembly was removed, then refer to article [SV365: Dual Fan Assembly Replacement Video](#) for instructions on reinstalling the standoffs.

1. Seat the dual fan assembly in the housing.
2. Tighten the four T10 screws.

- T10: 923-00669



3. Reconnect the left and right fan flex cables to the logic board. Gently press the Mylar tabs down.



4. Install new [display panel VHB strips](#).

5. Reinstall the [display panel](#).

Chin Strap

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)



Tools

- ESD wrist strap and mat
- Phillips #00 screwdriver (magnetized)
- ESD-safe tweezers (optional)
- Black stick
- Service wedge (iMac)



Steps For Removal

1. Remove nine Phillips #00 screws.

- #00: 923-01905



2. Set the chin strap aside. **Caution:** Be careful not to bend the chin strap.



Steps For Reassembly

1. Insert the chin strap into the rear housing. Be sure the metal screw holes face the inside edge of the chin on the rear housing. The foam edge on the chin strap should be facing up.



2. Use a black stick or tweezers to press the chin strap against the front frame, if needed.



3. Install the nine Phillips #00 screws.

- #00: 923-01905

4. Install new [display panel VHB strips](#).

5. Reinstall the [display panel](#).

Right Speaker

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)
- [Chin Strap](#)

Important: Speakers must be replaced in pairs. If you replace the right speaker, then you must also replace the left speaker. For left speaker removal and reassembly instructions, refer to article [RP1414: Left Speaker](#).



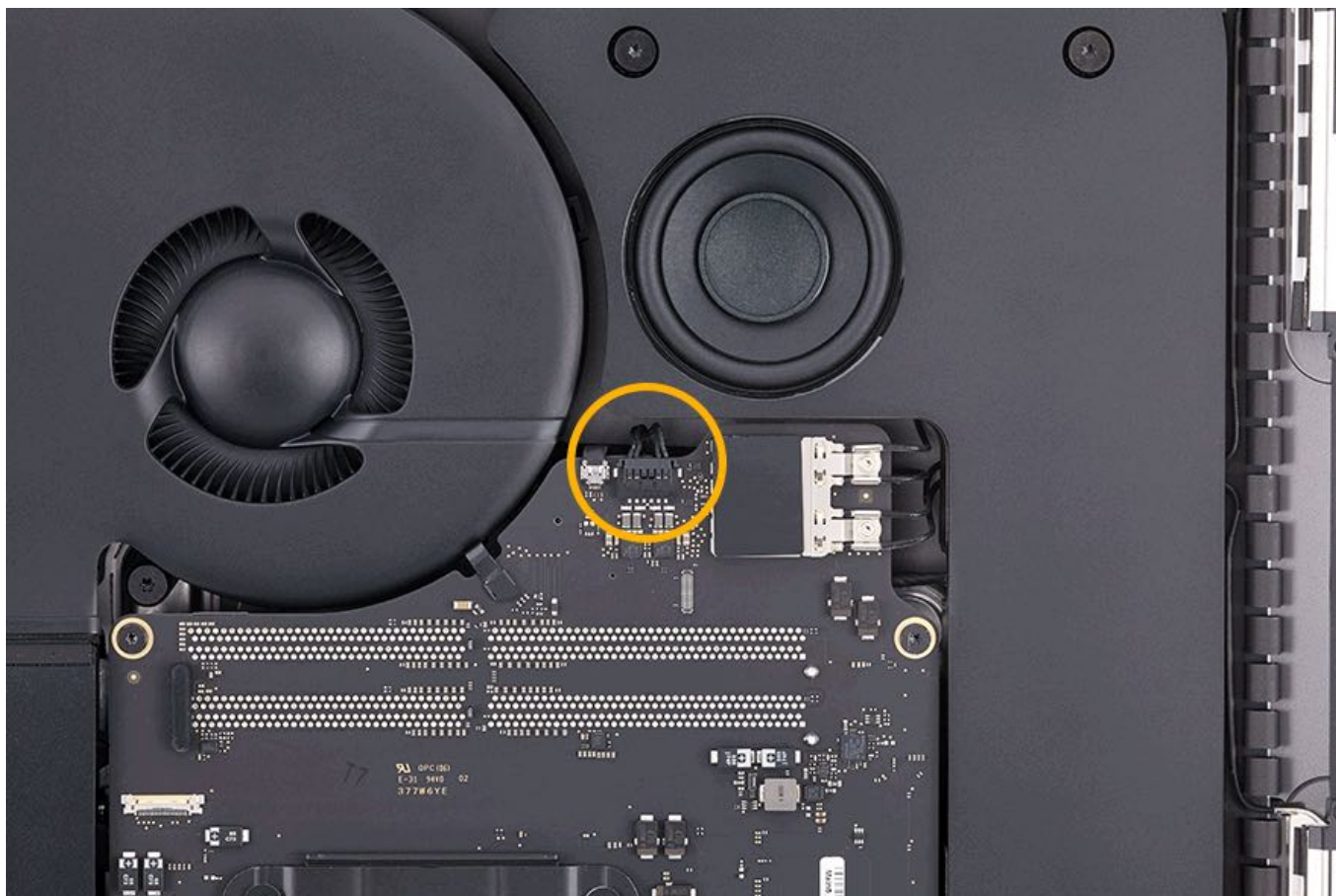
Tools

- ESD wrist strap and mat
- Torx T10 screwdriver (magnetized)
- Black stick
- Service wedge (iMac)



Steps For Removal

1. Use two fingers or a black stick to slide out and disconnect the speaker cable located at the top of MLB near the wireless card connector.



2. Remove three identical T10 screws.

- T10: 923-0333





3. Tilt the speaker slightly to the right. Notice the flex cable routes under the wireless card on the logic board. Lift the speaker out of the enclosure.



Steps For Reassembly

1. Carefully insert the speaker all the way into the rear housing.

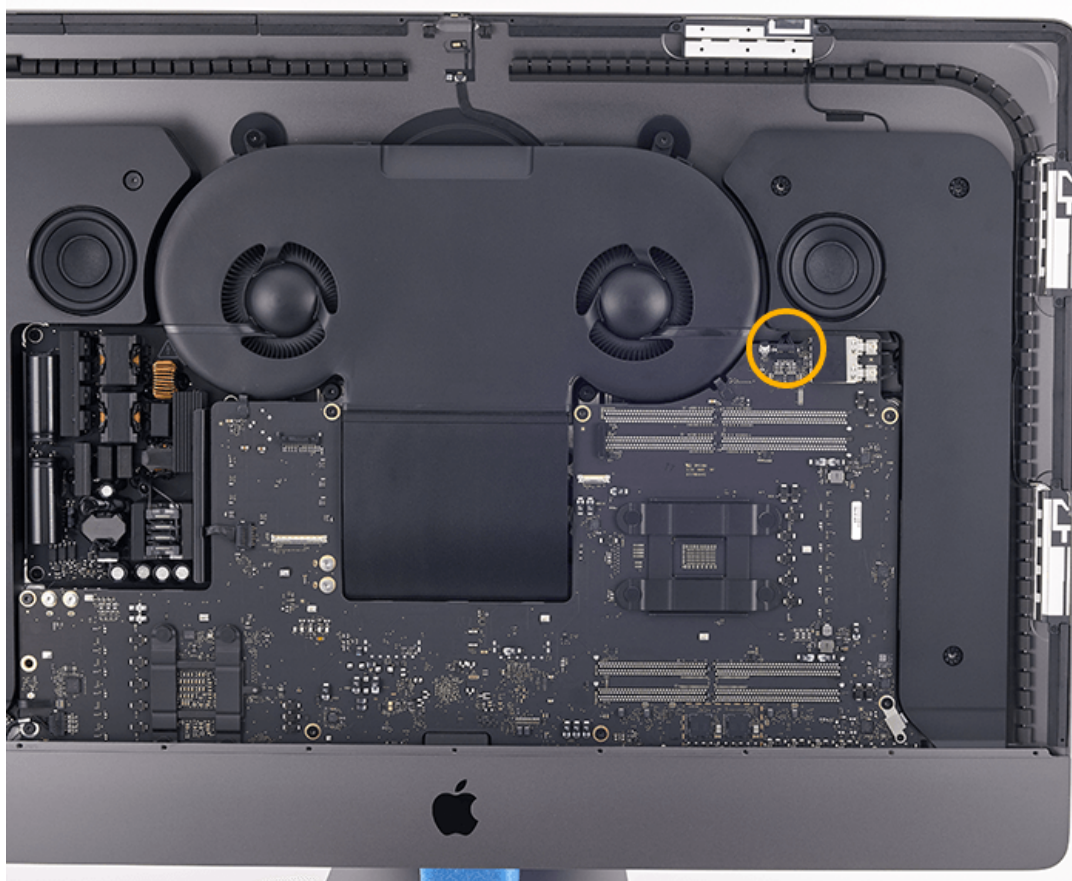
Note: Push firmly to ensure that the speaker sits down inside the rear housing as far as possible. If the speaker is not

positioned correctly in the rear housing, then it can cause display interference issues.



2. Route the flex cable under the wireless card on the logic board.

3. Connect the speaker cable to the logic board.



4. Install the three T10 speaker screws.

- T10: 923-0333



5. Reinstall the [chin strap](#).
6. Install new [display panel VHB strips](#).
7. Reinstall the [display panel](#).

Left Speaker

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)
- [Chin Strap](#)

Important: Speakers must be replaced in pairs. If you replace the left speaker, then you must also replace the right speaker. For right speaker removal and reassembly instructions, refer to article [RP1413: Right Speaker](#).



Tools

- ESD wrist strap
- Torx T10 screwdriver (magnetized)
- Torx T8 screwdriver (magnetized)
- Black stick
- Service wedge (iMac)



Steps For Removal

1. Use a T8 screwdriver to remove the ground screw that secures the left speaker cable with an O-ring to the lower left corner of the logic board.

- T8: 923-0331



2. Disconnect the flex cable from the logic board.



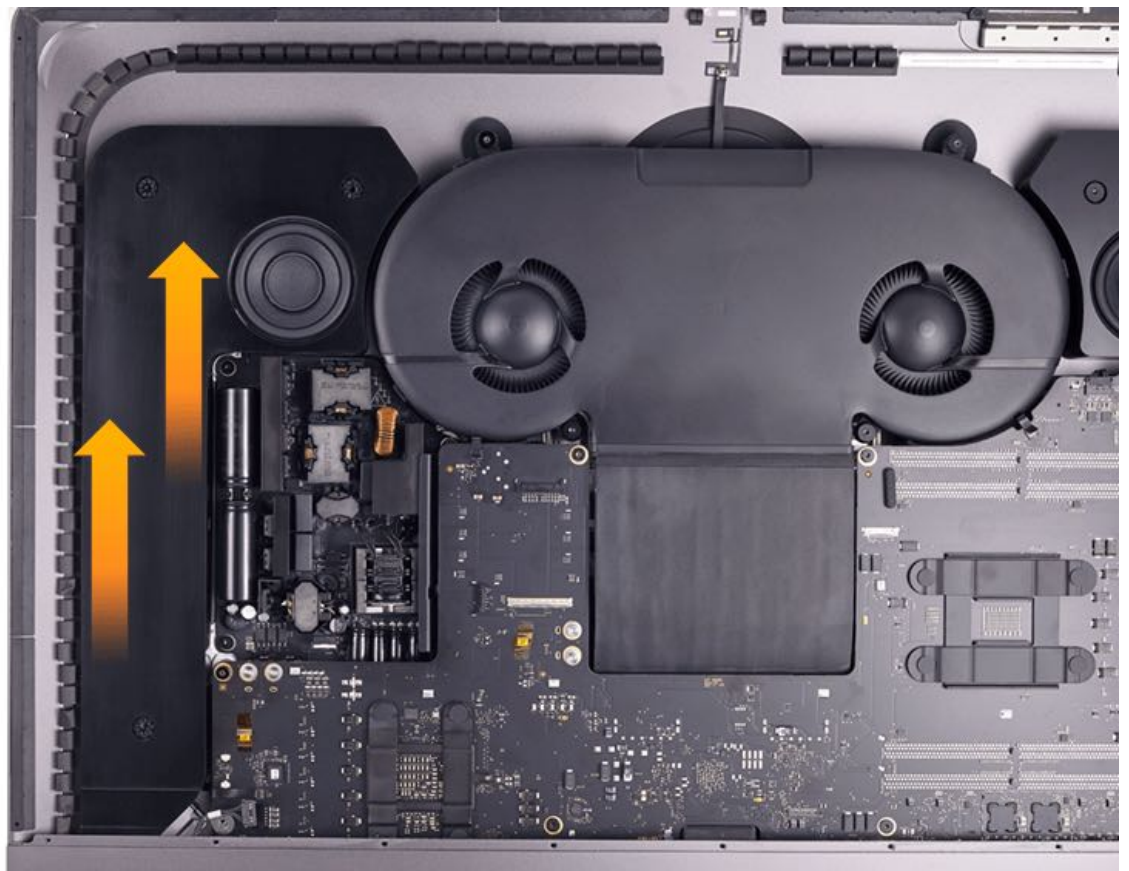
3. Remove the three identical T10 screws.

- T10: 923-0333





4. Tilt the speaker up and rock it gently to remove it from the pocket in the housing.



Steps For Reassembly

1. Carefully insert the speaker all the way into the rear housing.

Note: Push firmly to ensure that the speaker sits down inside the rear housing as far as possible. If the speaker is not positioned correctly in the rear housing, then it can cause display interference issues.

2. Connect the speaker cable to the logic board.



3. Use a T8 screwdriver to reconnect the ground screw to the lower left corner of the logic board.

- T8: 923-0331





5. Reinstall the three identical T10 screws.

- T10: 923-0333





10. Reinstall the [chin strap](#).
11. Install new [display panel VHB strips](#).
12. Reinstall the [display panel](#).

Antennas

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

Note: There is a fourth antenna that is permanently attached to the rear housing. If this antenna is damaged, the rear housing must be replaced.

Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)
- [Chin Strap](#)
- [Right Speaker](#)

1. Upper Antenna
2. Middle Antenna
3. Lower Antenna



Tools

- ESD wrist strap
- Service wedge (iMac)
- Wireless support tool (923-02218)
- Torx T4 screwdriver (magnetized)
- Torx T5 screwdriver (magnetized)
- Antenna tool (923-01322)
- Black stick

- ESD-safe tweezers (optional)



Steps For Removal

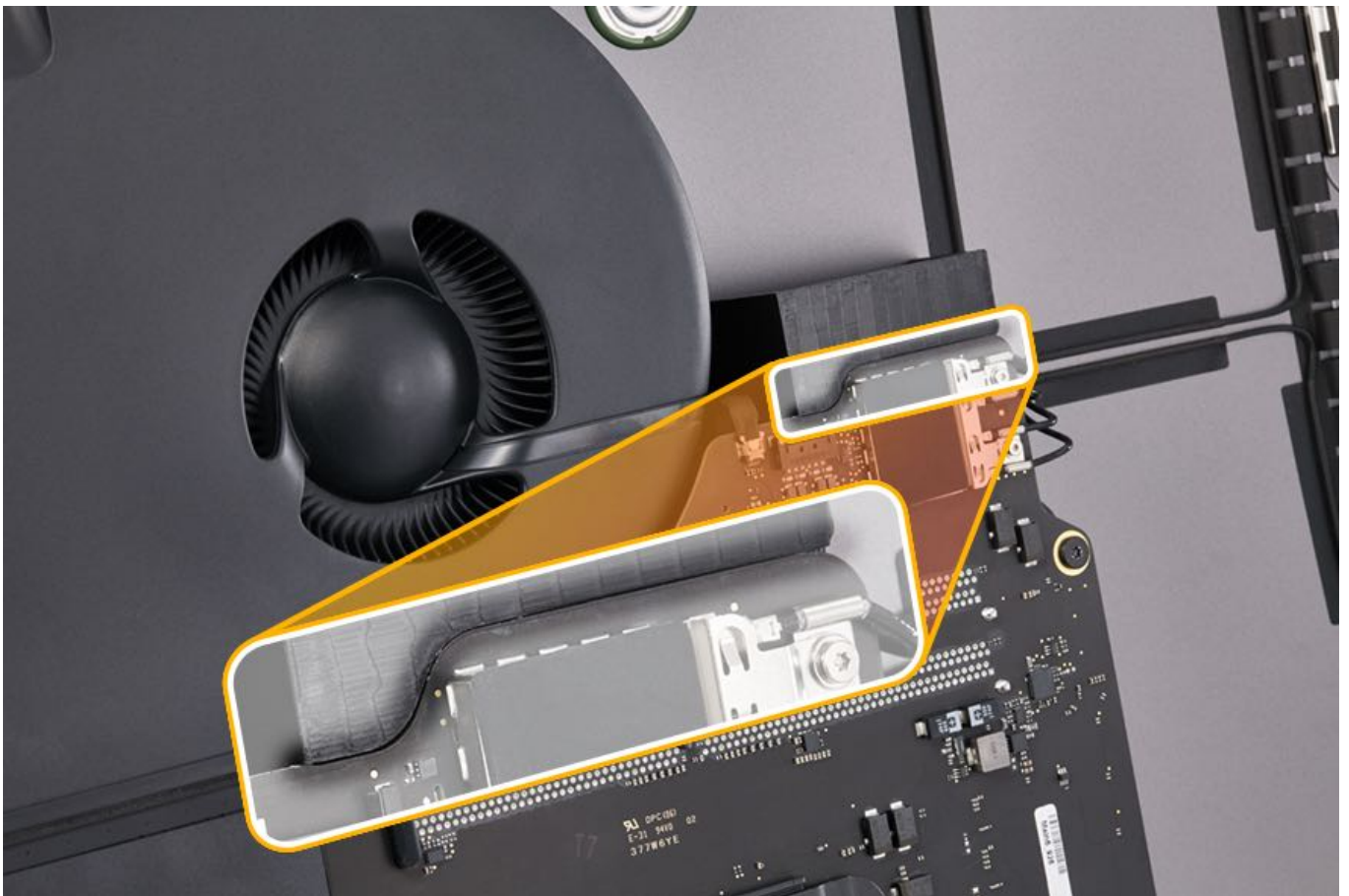
Note: The images shown here are of the Bluetooth antenna. The procedure is the same for all three antennas.

1. To protect the logic board, slide the wireless support tool into place behind the right corner of the logic board.



2. Secure the tool in place by sliding it to the right and making sure it lines up correctly.

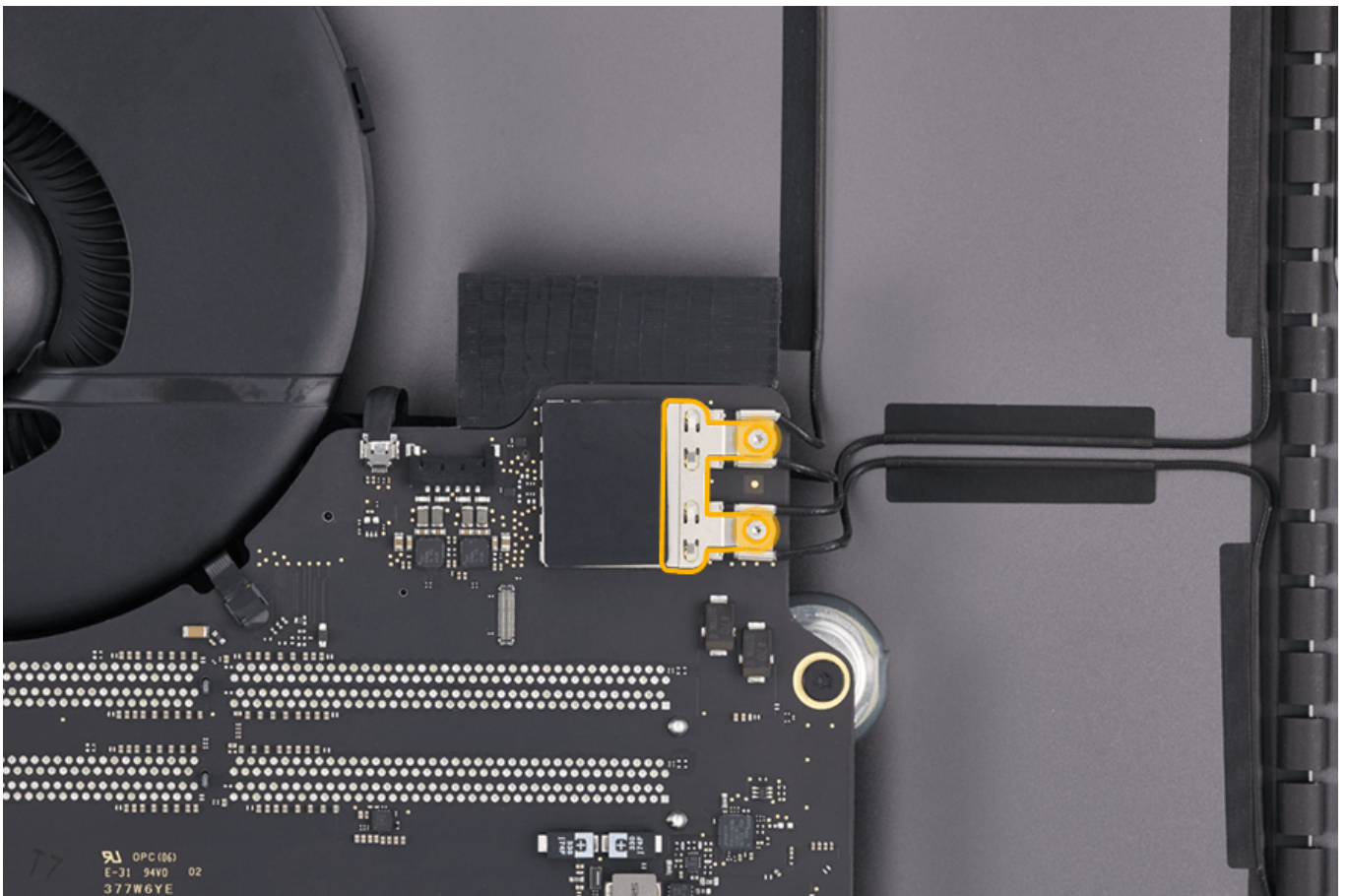
Caution: Keep the support tool in position while removing or replacing screws and when disconnecting or reconnecting antenna cables to avoid flexing the logic board.



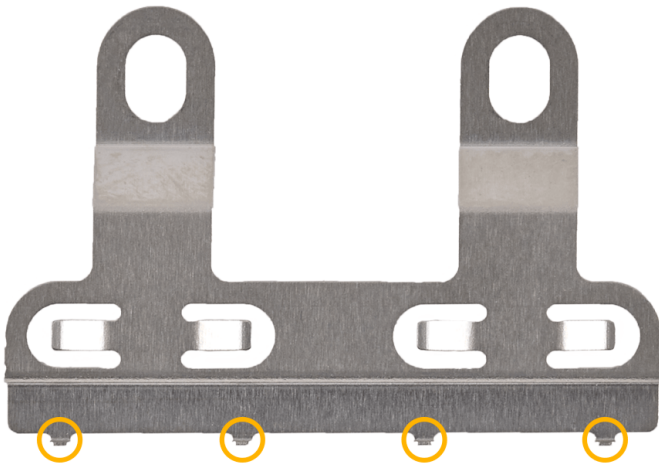
3. Remove the two T5 screws holding the antenna clip in place and remove the antenna clip.

- T5: 923-02294

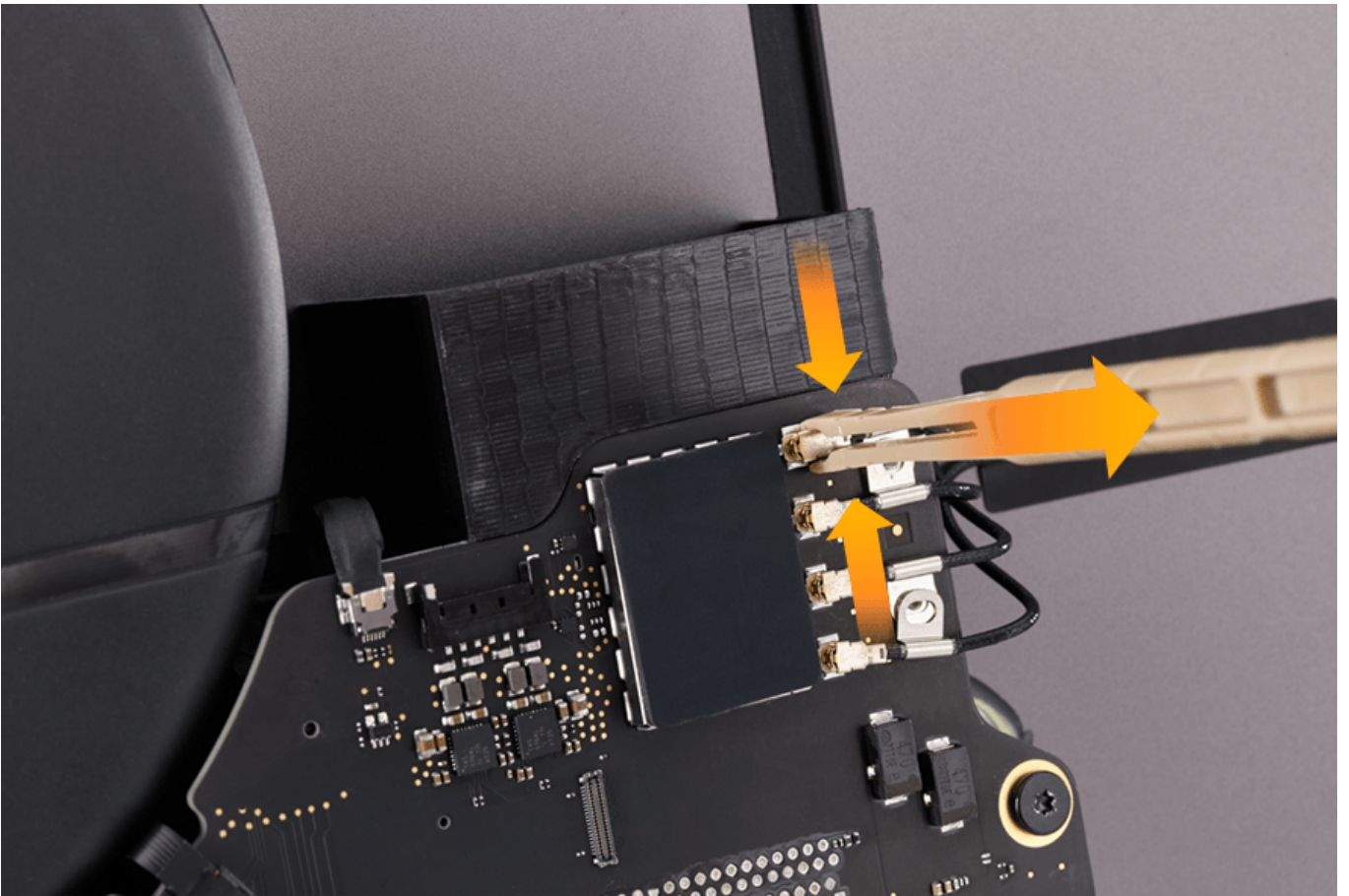




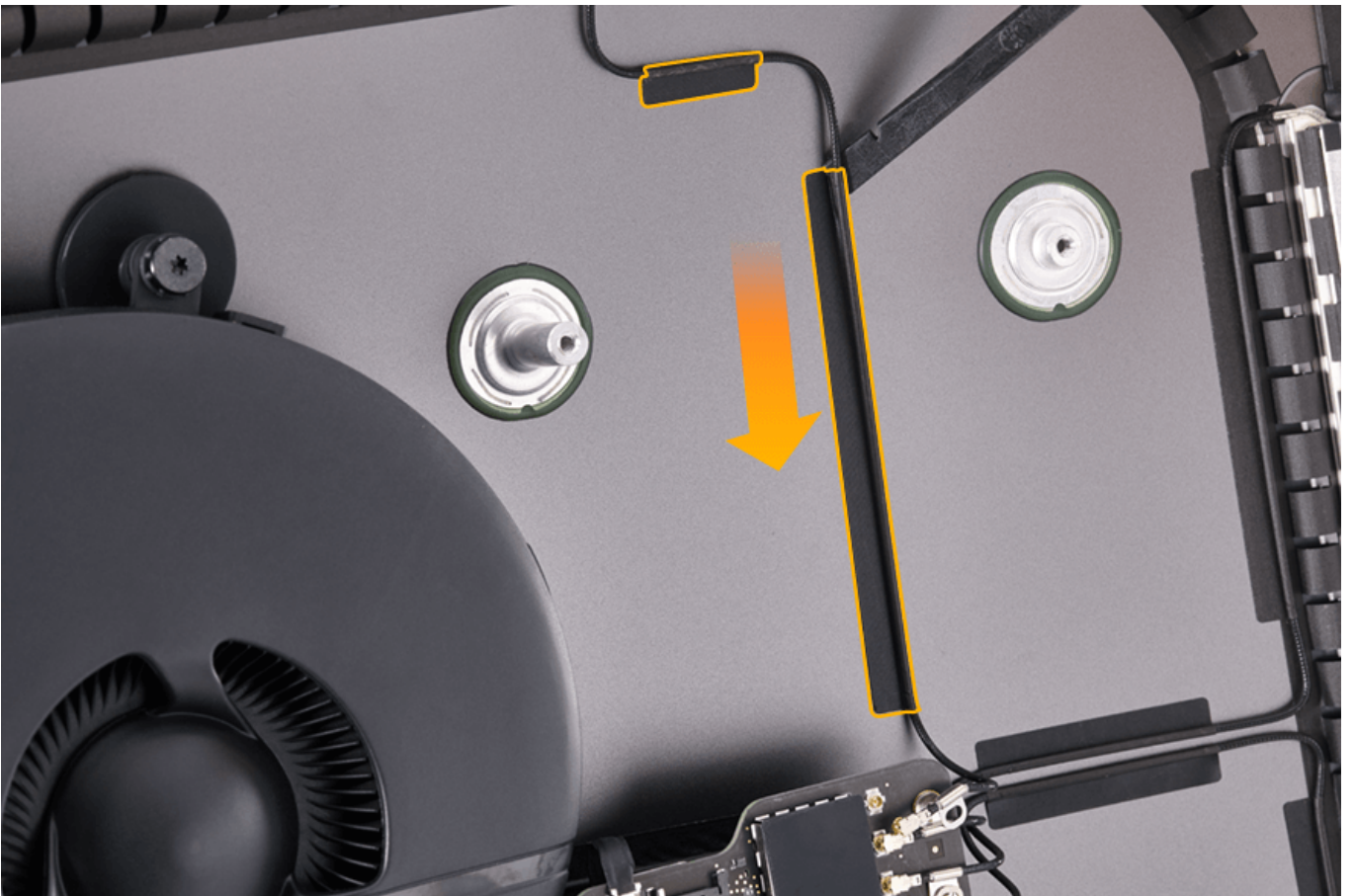
4. Make note of the teeth on the antenna clip for reassembly.



5. Use the antenna tool to disconnect the antenna.

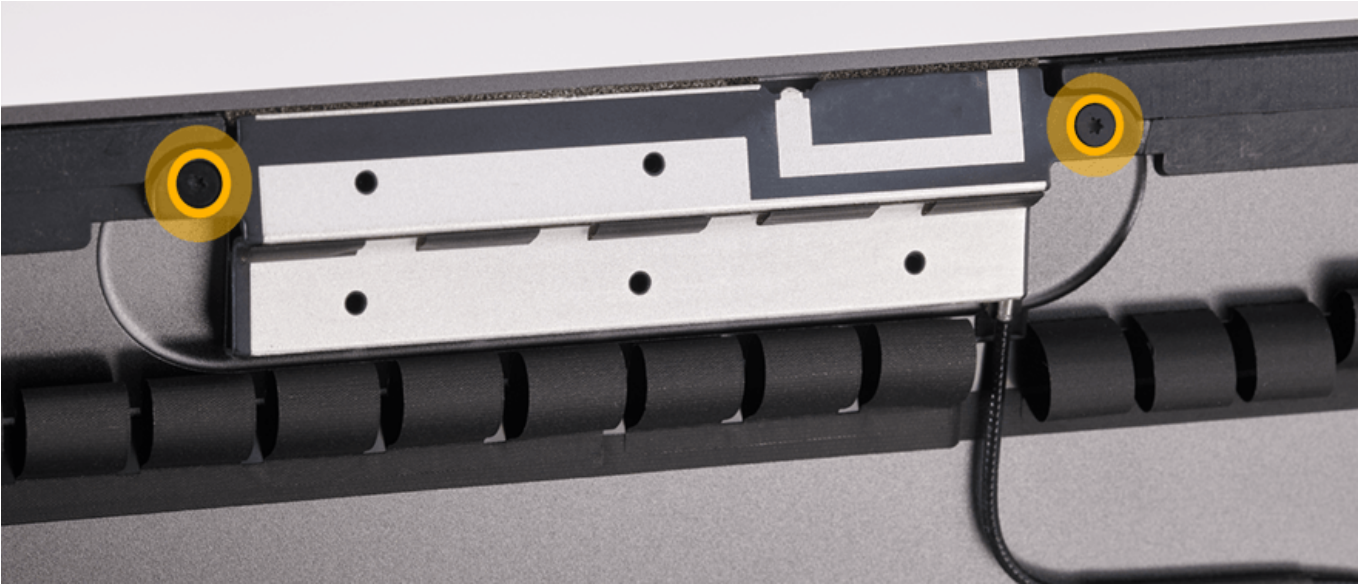


6. With a black stick, remove the tape that affixes the antenna to the enclosure.



7. Remove the two identical T4 screws from the antenna and gently remove the antenna from the enclosure.

- T4: 923-0304



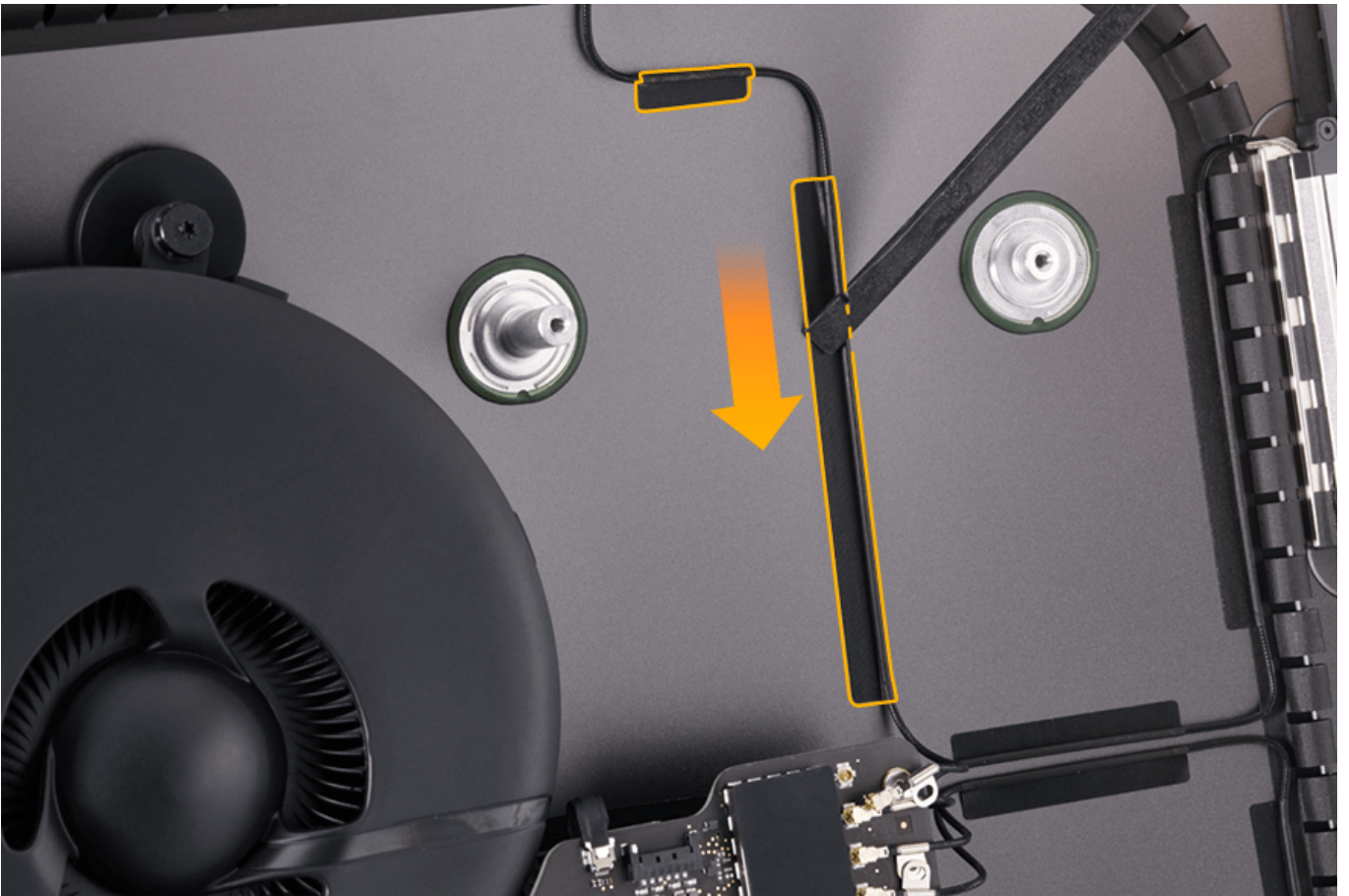
Steps For Reassembly

1. Install two T4 screws to secure the antenna body to the rear housing.

- T4: 923-0304



2. Using a black stick, press the tape down to secure the antenna the rear housing.

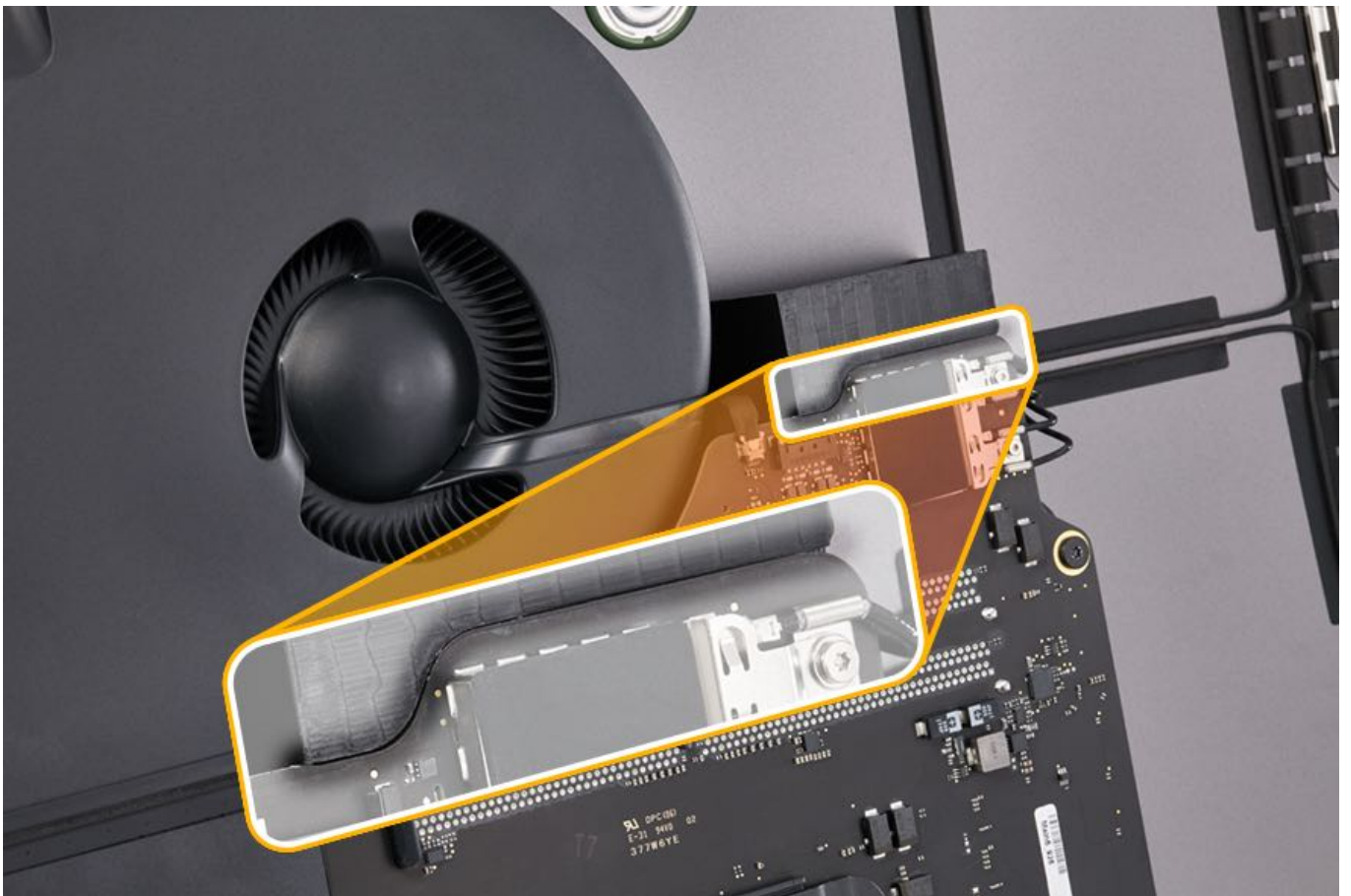


3. To protect the logic board, slide the wireless support tool into place behind the right corner of the logic board.

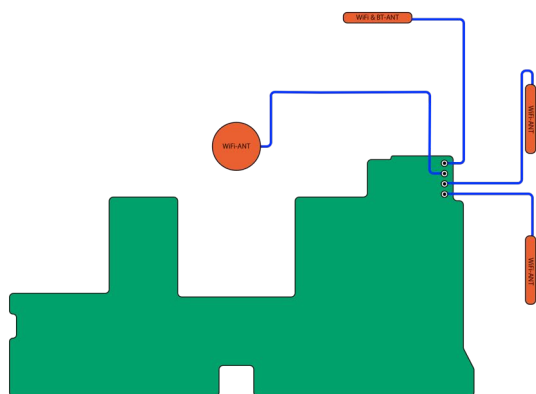


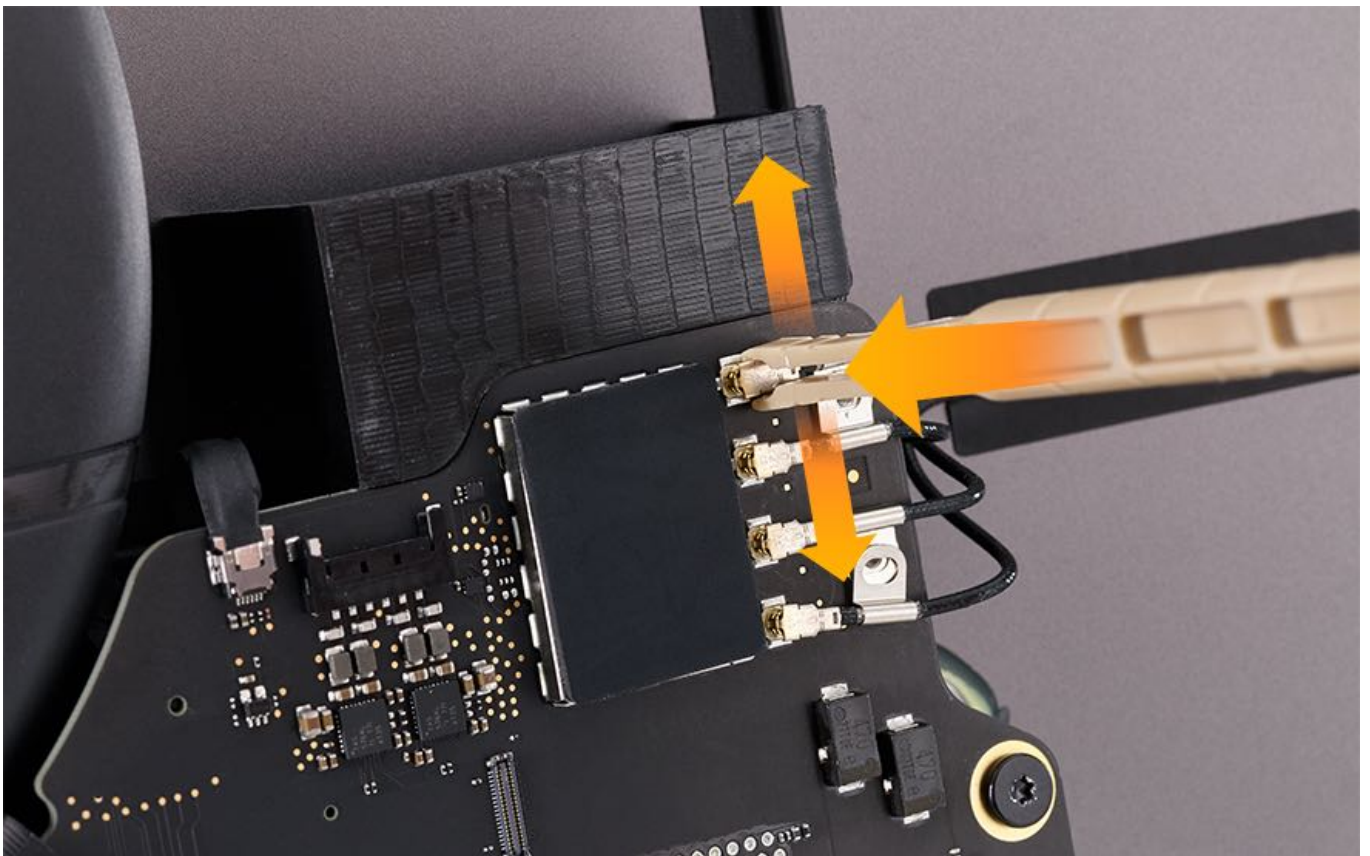
4. Secure the tool in place by sliding it to the right and making sure it lines up correctly.

Caution: Keep the support tool in position while removing or replacing screws and when disconnecting or reconnecting antenna cables to avoid flexing the logic board.

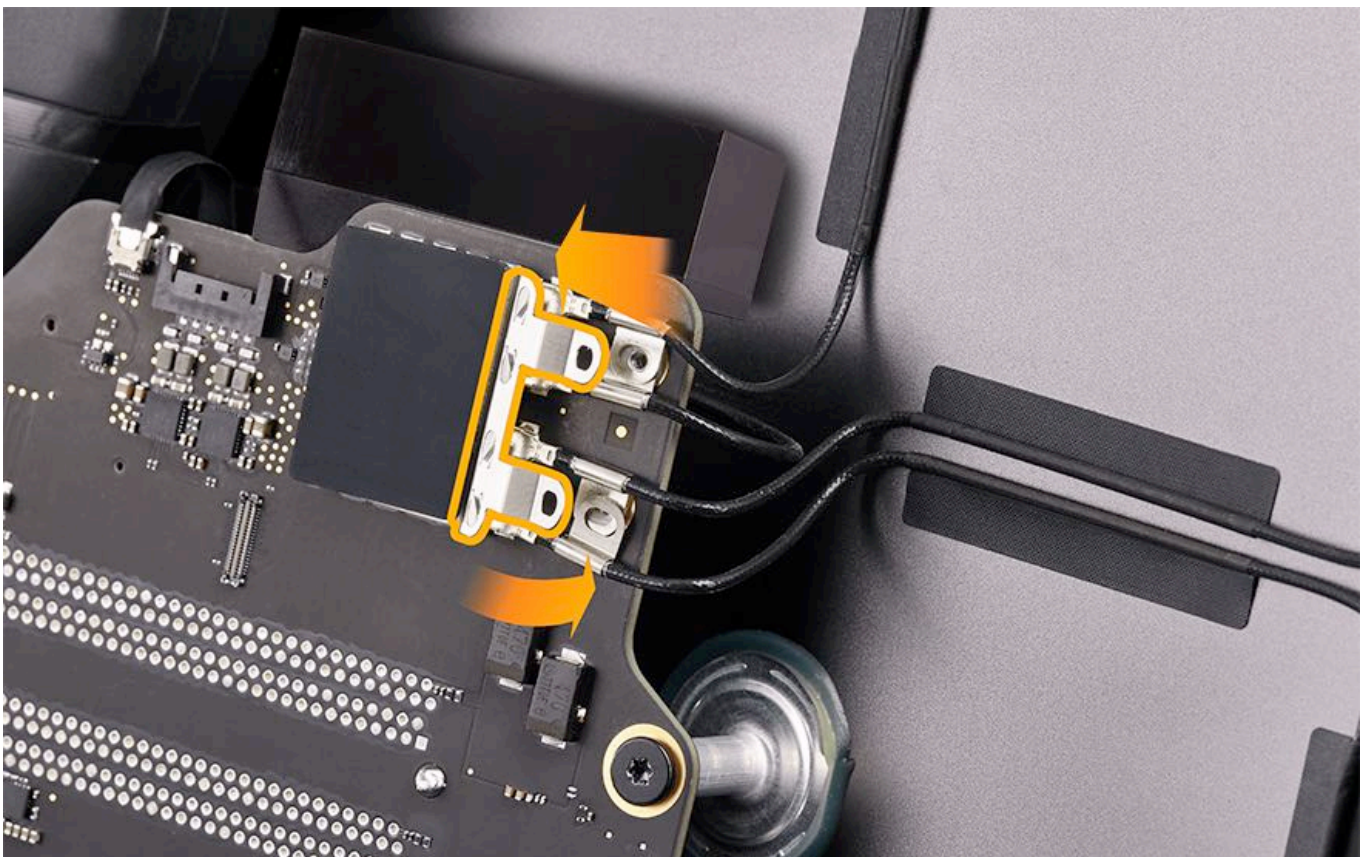


5. Use the antenna tool or ESD-safe tweezers to reconnect the antenna cable.





6. Reinstall the antenna clip by engaging the teeth at an angle and then lay it down over the antennae.



7. Reinstall the two T5 screws.

- T5: 923-02294



8. Remove the wireless support tool from the rear housing.
9. Reinstall the [right speaker](#).
10. Reinstall the [chin strap](#).
11. Install new [display panel VHB strips](#).
12. Reinstall the [display panel](#).

Logic Board

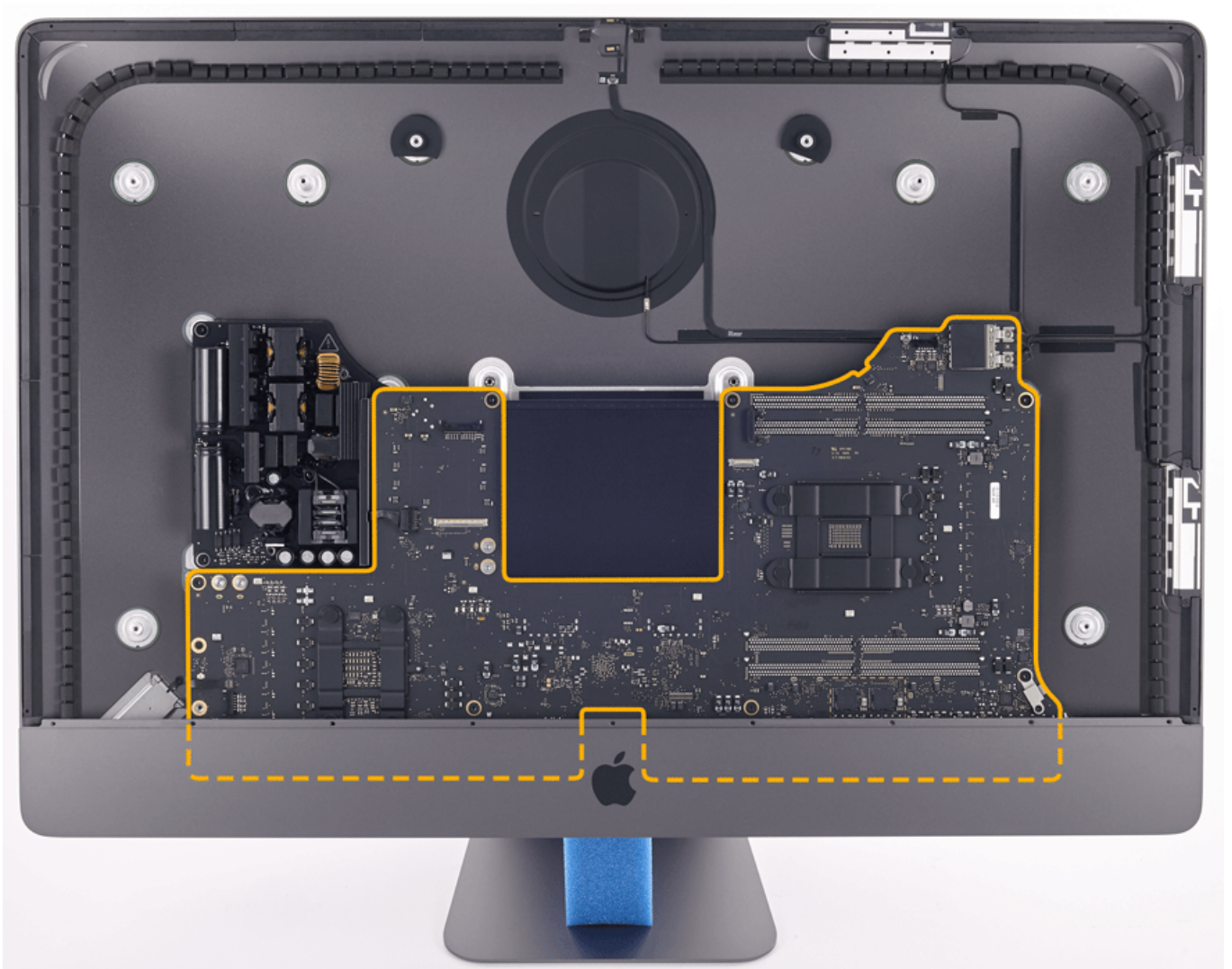
First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

For video instruction, refer to article [SV366: Logic Board Replacement Video](#).

Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)
- [Dual Fan Assembly](#)
- [Chin Strap](#)
- [Right Speaker](#)
- [Left Speaker](#)



Tools

- ESD wrist strap
- ESD-safe tweezers
- Black stick
- Torx T4 screwdriver
- Torx T5 screwdriver
- Torx T8 screwdriver
- Adjustable torque driver 0.3–1.2 N m (923-0735)
- T8 security bit (923-0734)
- Service wedge (iMac)
- Wireless support tool (923-02218)
- Antenna tool (923-01322)
- Thunderbolt 3 cable or USB-C cable for reassembly

- Logic board service tray (076-00376)



Steps For Removal

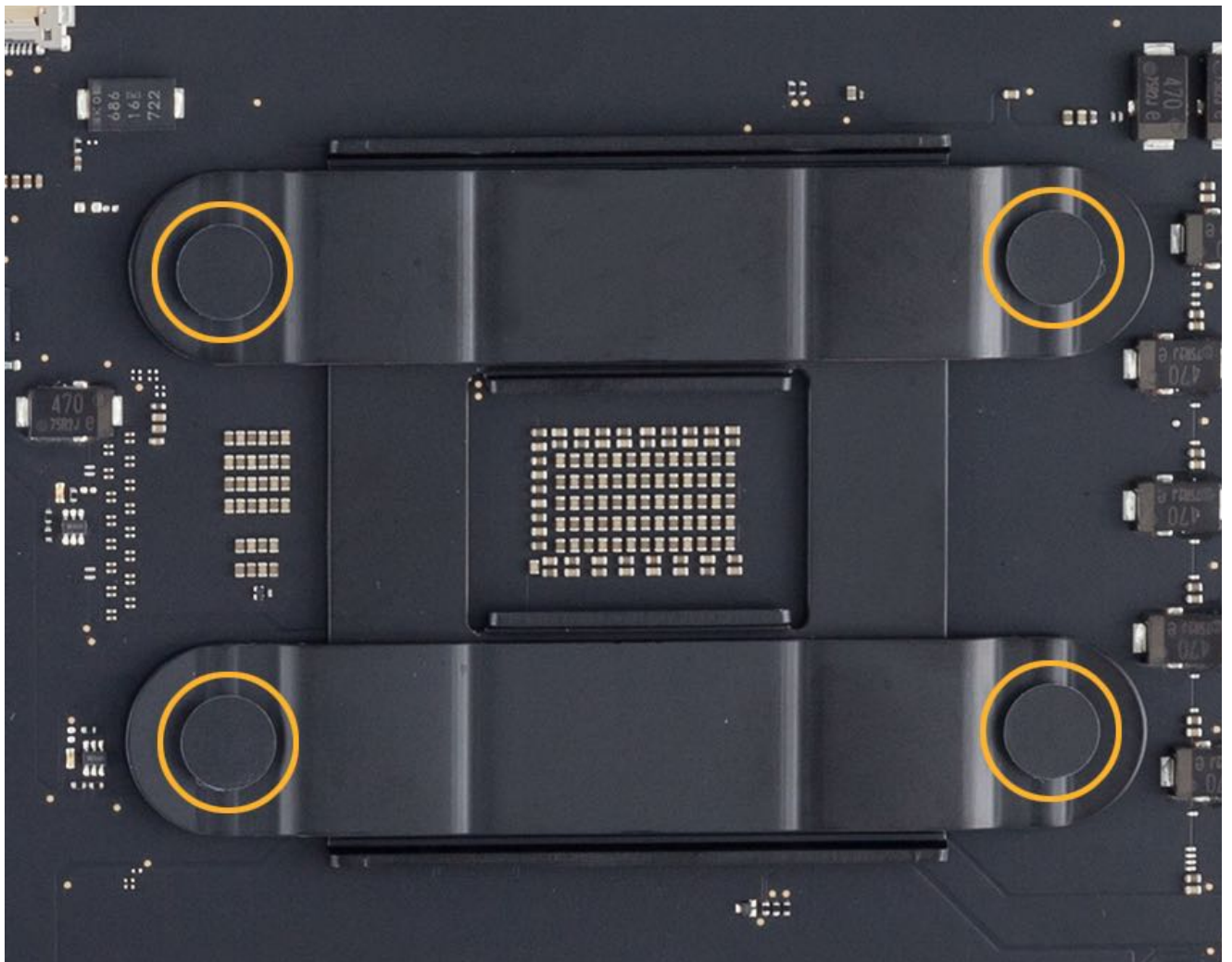


Caution: The iMac Pro (2017) will not start up after a logic board and/or flash storage replacement until the **Mac Configuration Utility (MCU)** is used. MCU is needed to serialize a logic board after a logic board replacement and to configure the flash storage after new flash storage is installed. For instructions on how to use MCU, refer to article [TP1625: How to Use Mac Configuration Utility](#) and service video [SV369: System Configuration after a Logic Board or Flash Storage Repair](#).

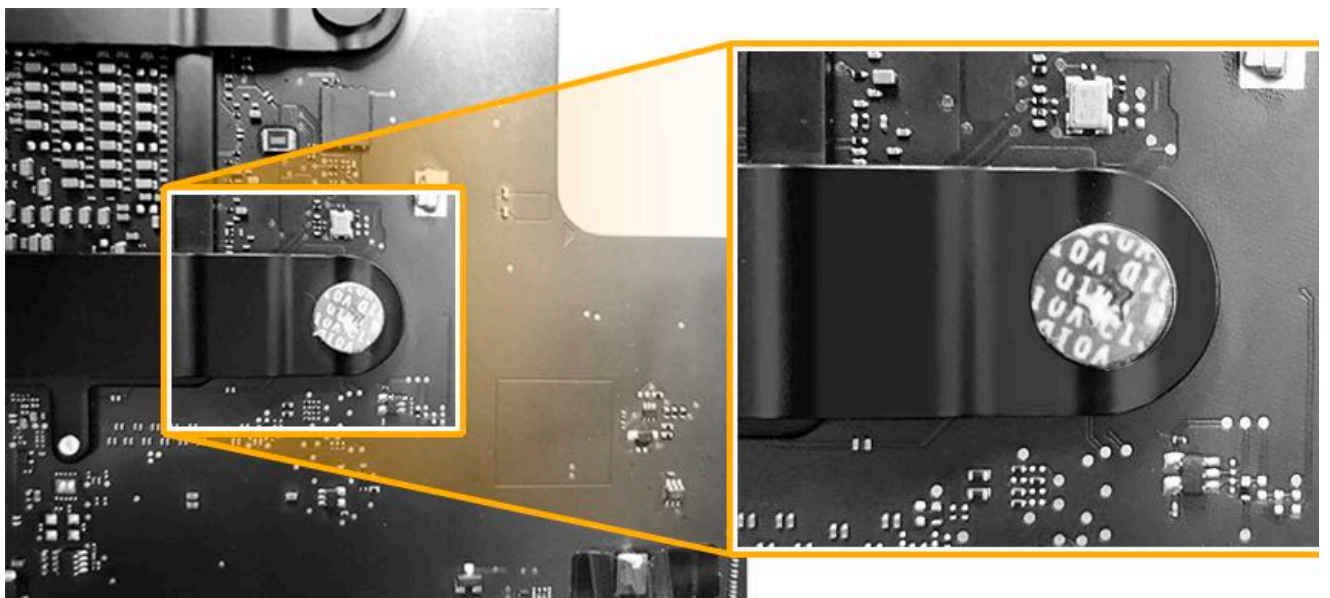
Note: In order to avoid flexing or causing damage to the logic board, always place the logic board in the logic board service tray when it is removed from iMac Pro (2017). Before removing the logic board, prepare the tray. For instructions, refer to article [TP1635: Logic Board Service Tray Instruction](#).

Important: Before replacing the logic board, check the CPU warranty labels for signs of tampering. If all four CPU warranty labels are intact, proceed with the repair. If the labels have been tampered with, the logic board should be replaced as an out-of-warranty repair.

- Intact labels:



- **Tampered labels:**



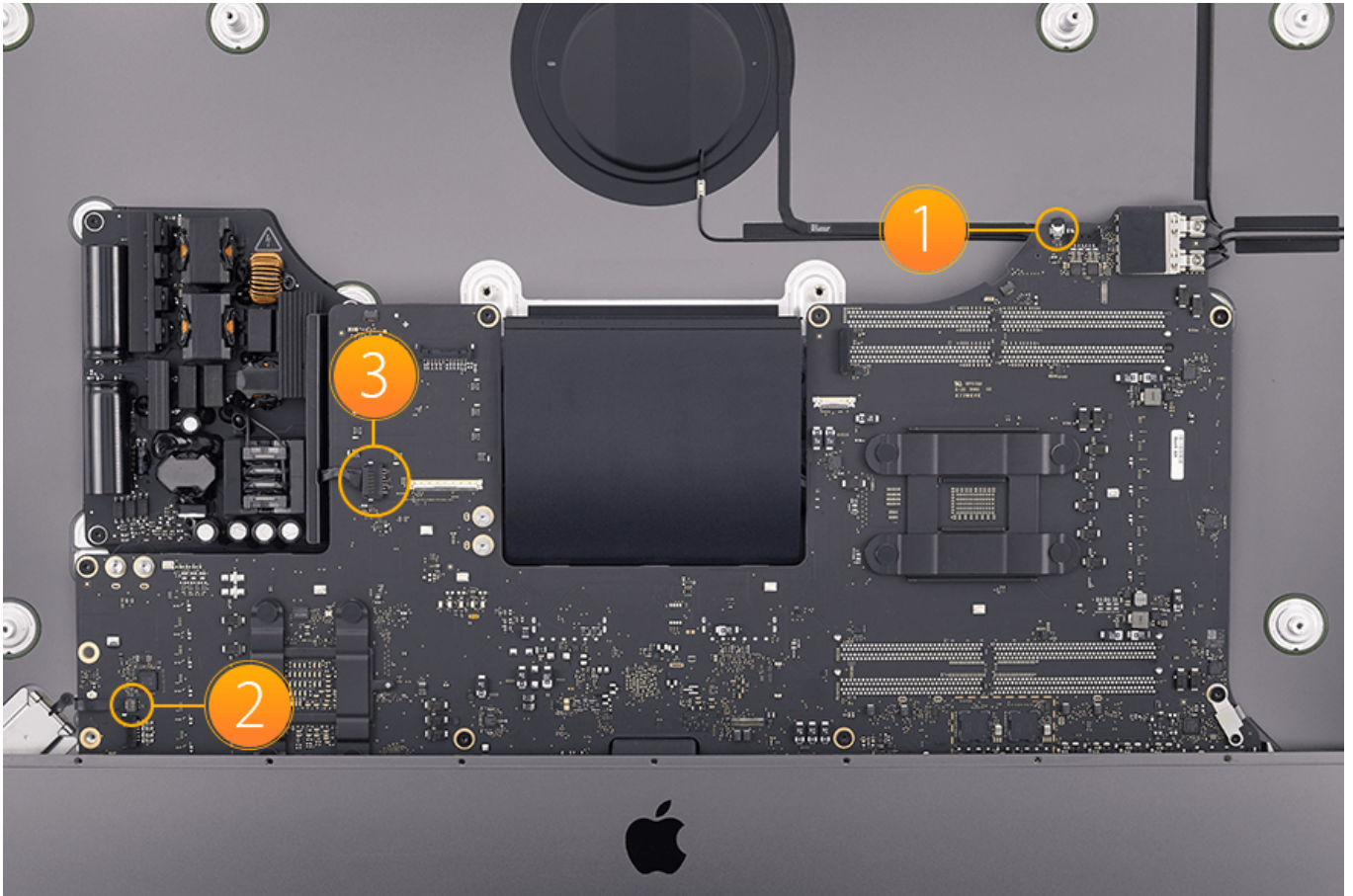
Procedure:

1. Carefully disconnect the following from the logic board:

1. Rear mic flex cable
2. Power button flex cable
3. Power supply flex cable



Caution: Be very careful with the power button flex cable. A broken cable requires a rear housing replacement. It is recommended to tape the cable to the rear housing with Kapton tape to avoid damaging it.



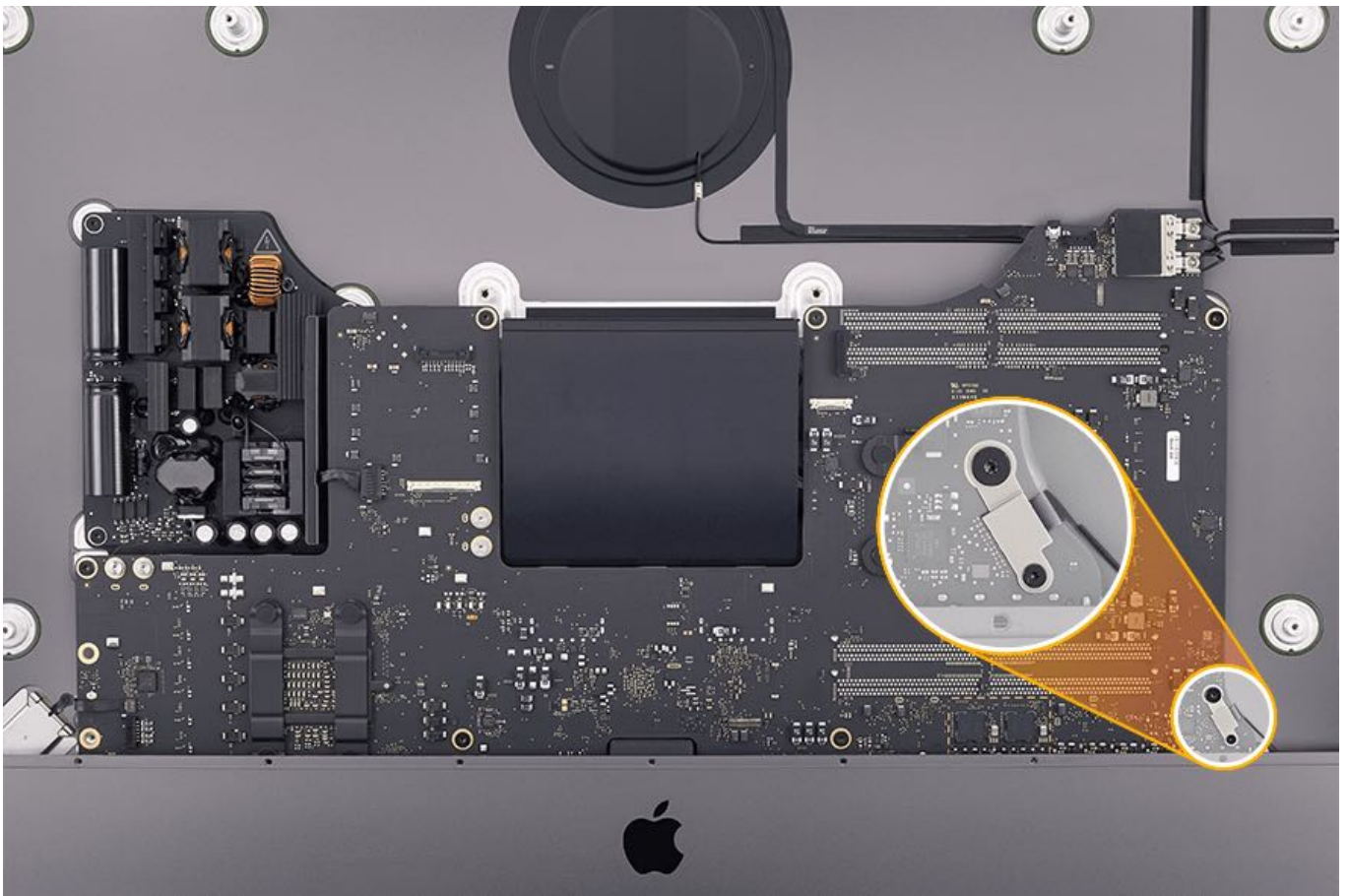
2. Remove the T8 and T5 screws, then remove the cowling over the audio jack connector.

- T8: 923-0331

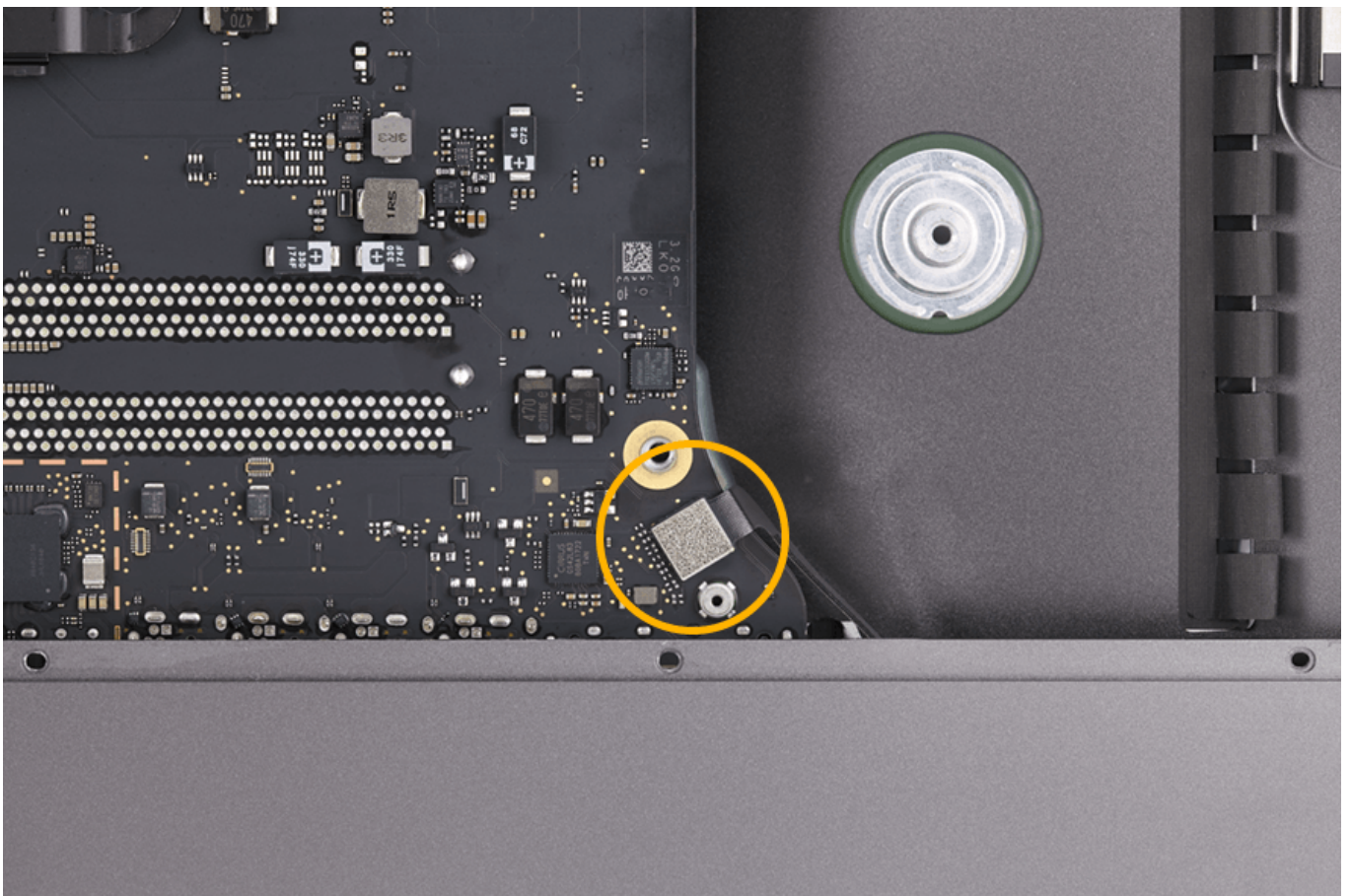


- T5: 923-02291





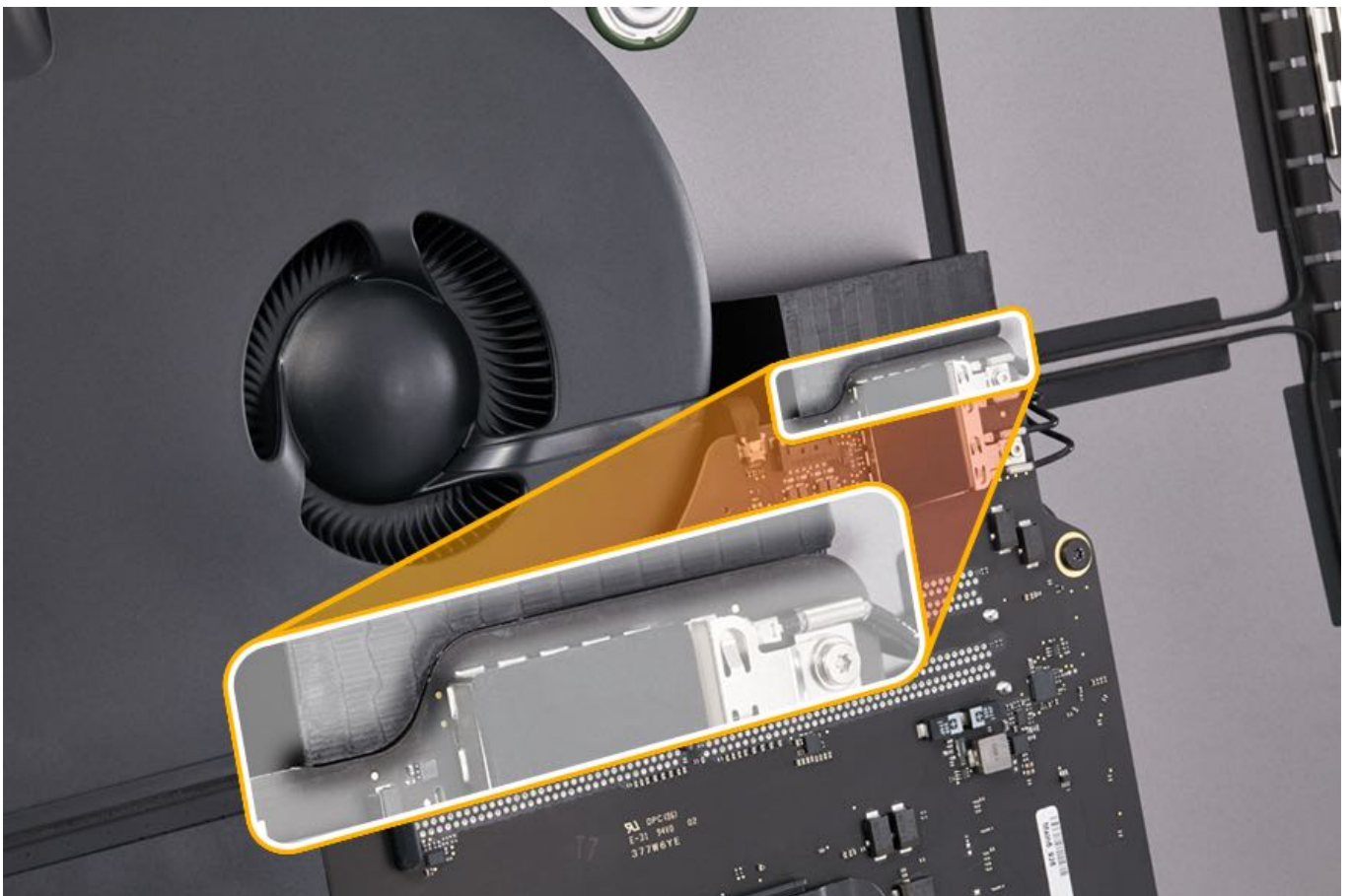
3. Disconnect the audio jack flex cable from the logic board.



4. To protect the logic board, slide the wireless support tool into place behind the right corner of the logic board.

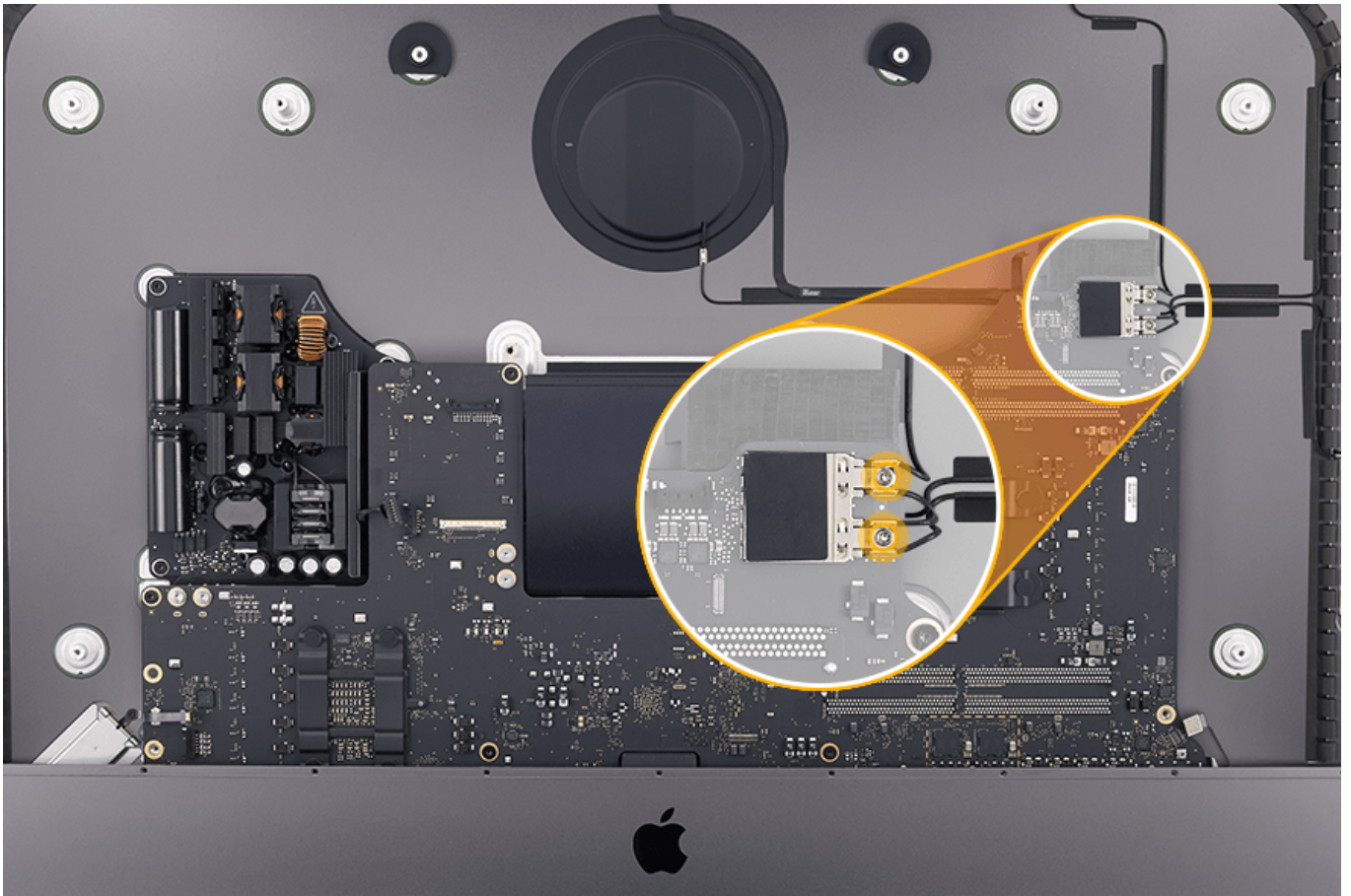


5. This image shows the wireless support tool correctly installed. Keep the tool installed whenever removing the antenna clip screws or wireless antennas.

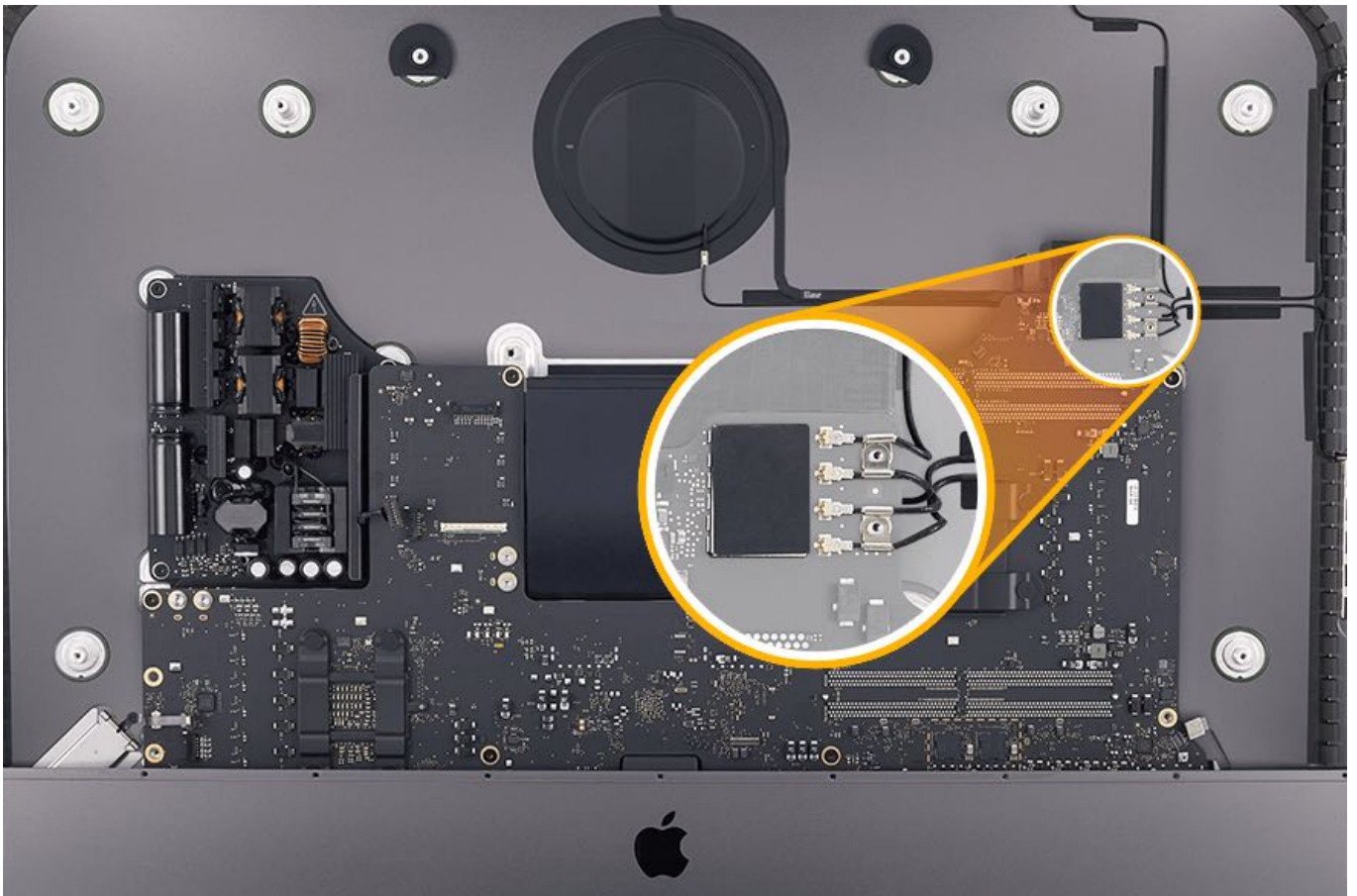


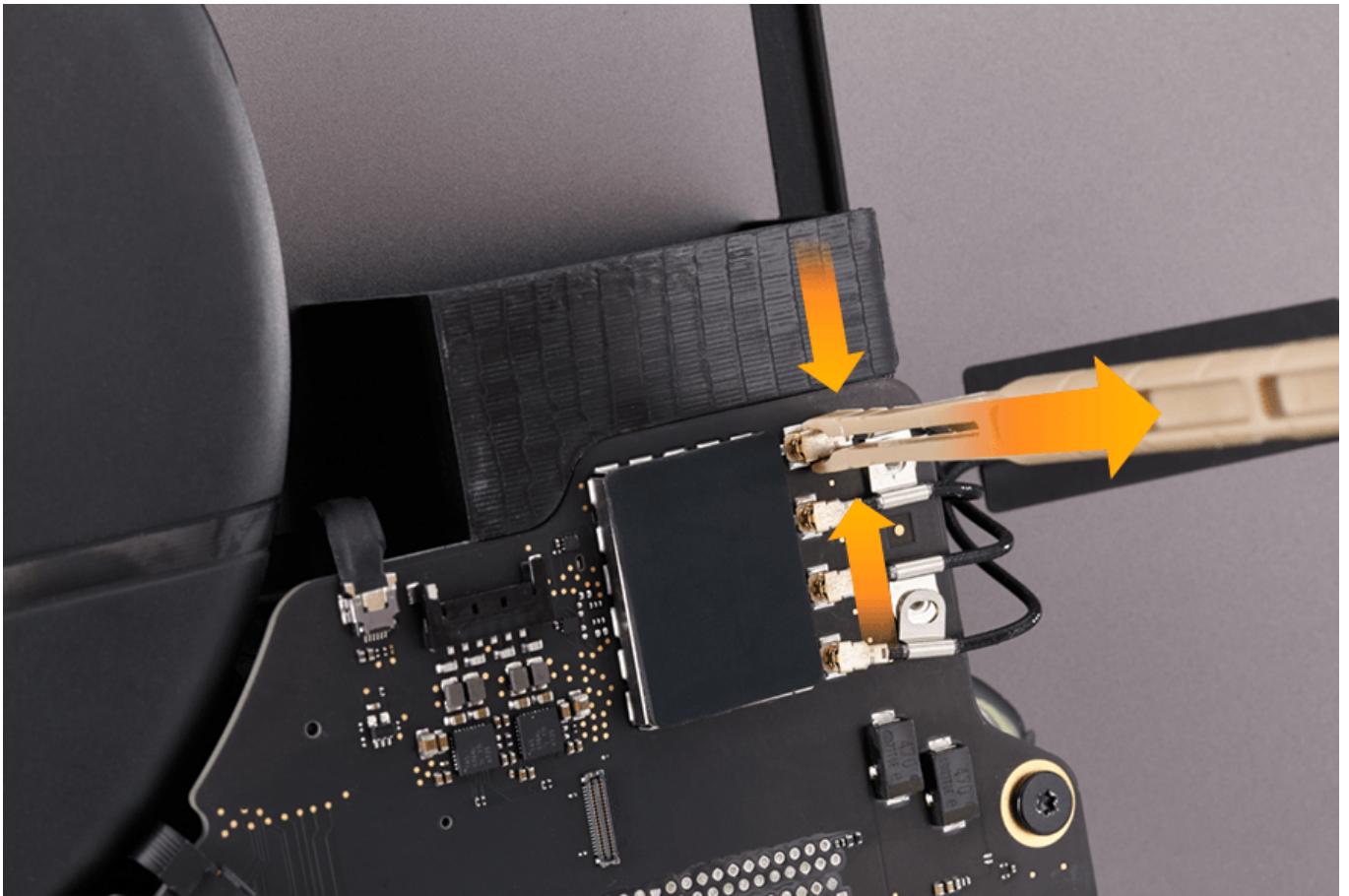
6. Remove the two T5 screws on the antenna clip and remove the clip. Make note of the teeth on the antenna clip for reassembly.

- T5: 923-02294



7. Disconnect the wireless cables with the antenna tool.



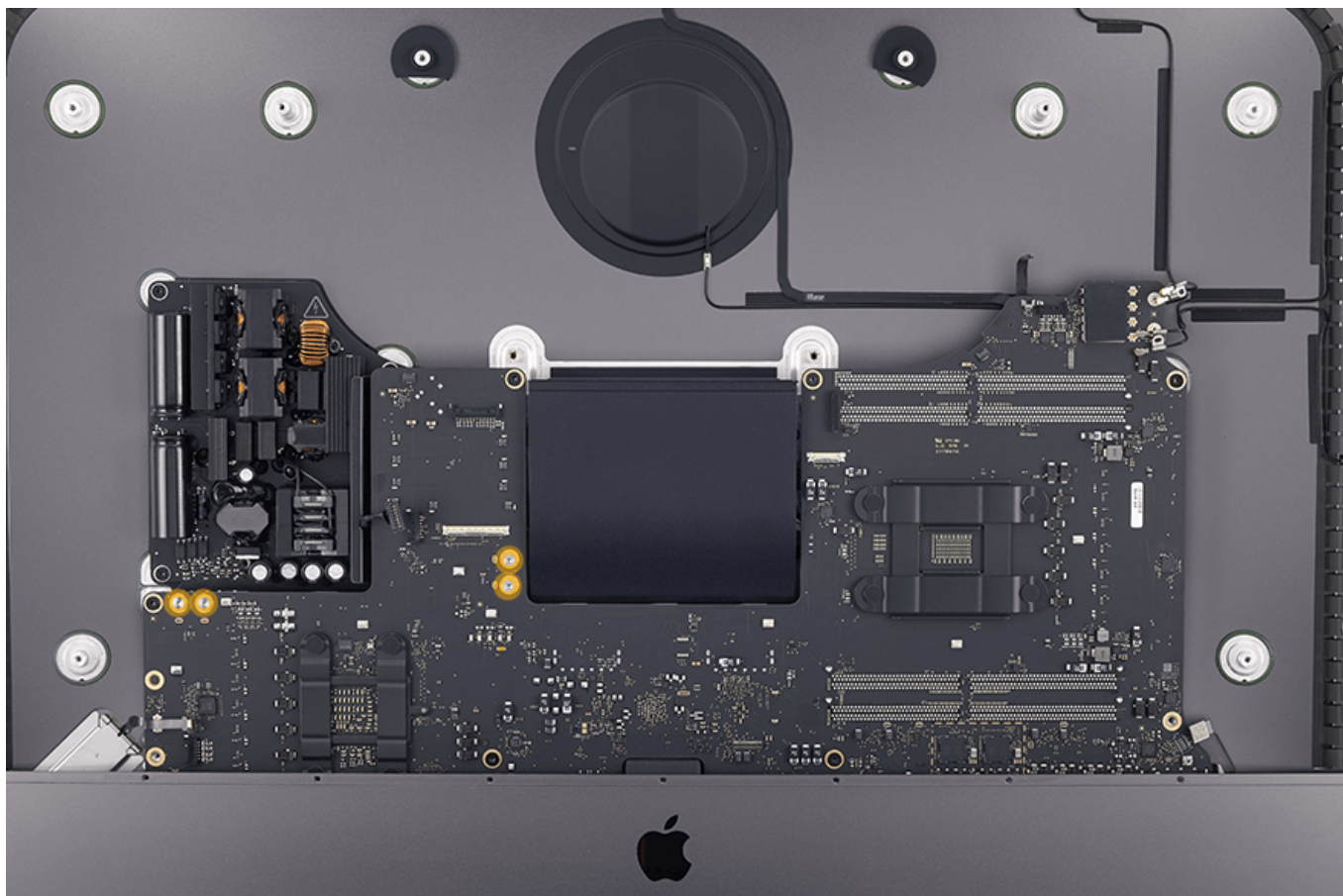


8. Remove the support tool from the enclosure.

9. Remove the four T8 bus bar screws and discard them. Use new screws every time they are removed. New screws come with a new logic board.

- T8: 923-02288





10. Remove the four short T8 screws and two long T8 screws (top middle) from the logic board.

- T8 short: 923-0331

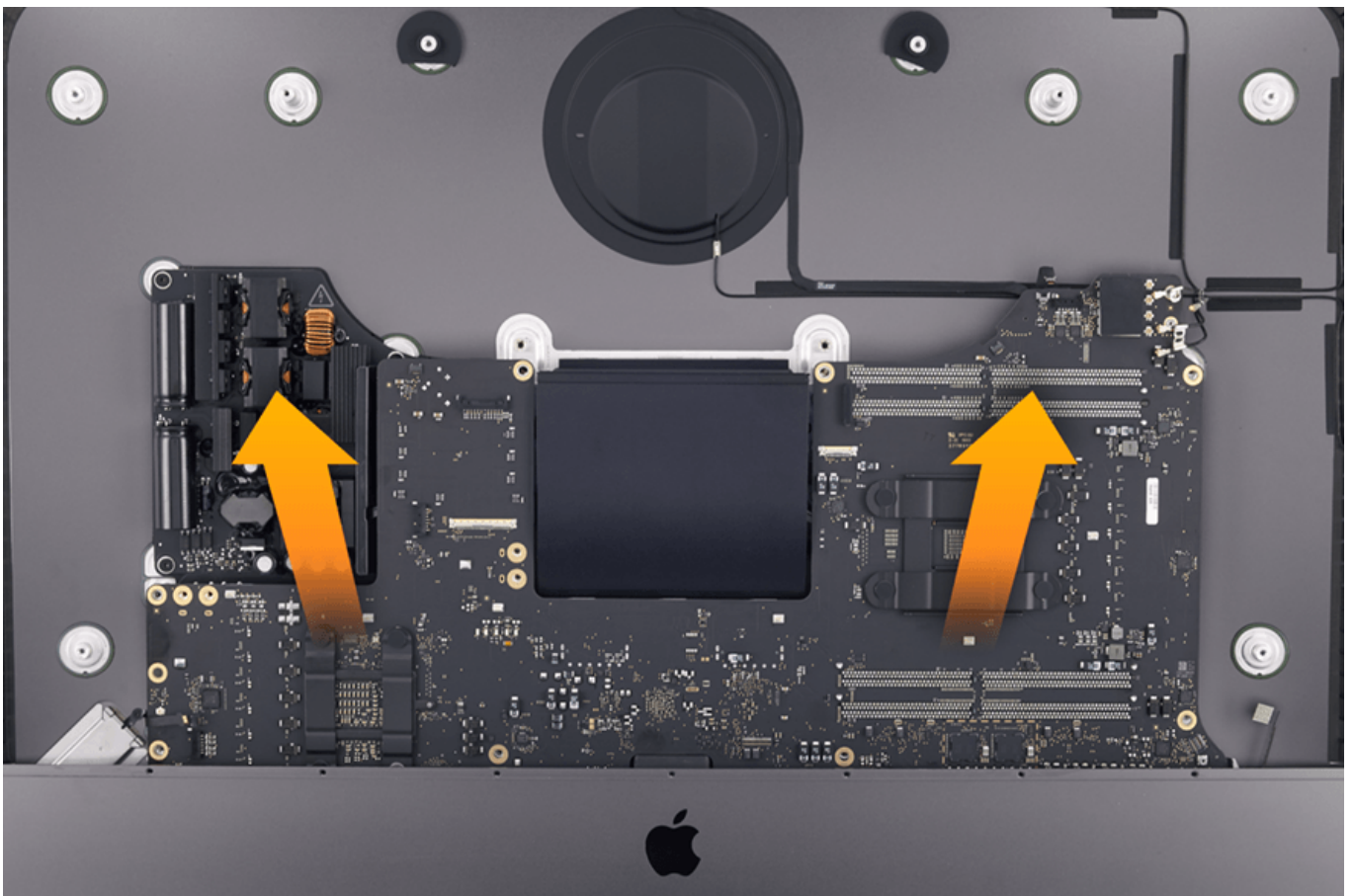


- T8 long: 923-0396





11. With two hands, gently grasp the logic board on the right and left side. Be careful not to flex the logic board while tilting it forward slightly.



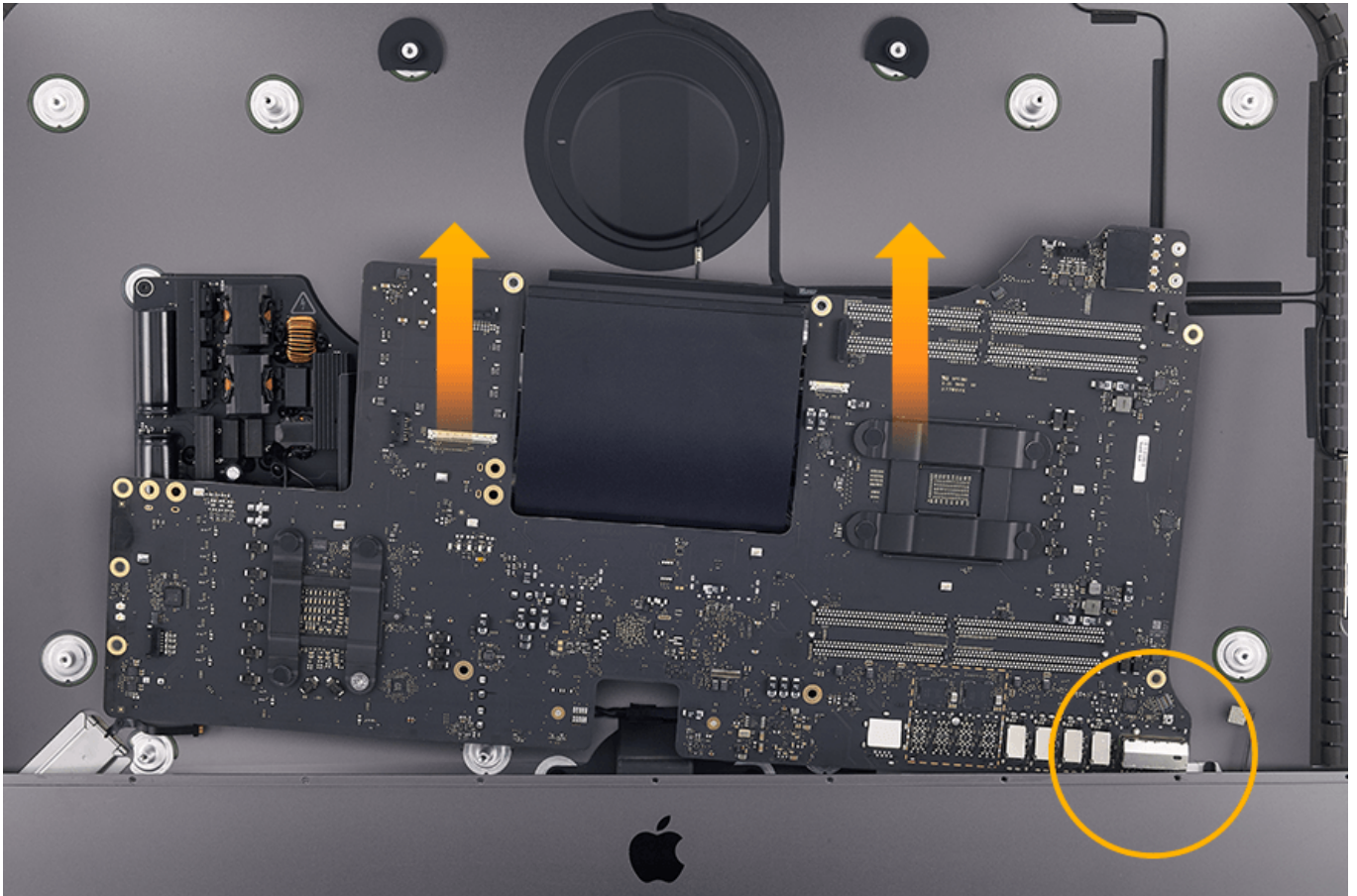
12. Tilt the board slightly to the right, then up and out, making sure to clear the SD card reader on the bottom right.

Caution:

- Handling the logic board incorrectly can damage chips and circuits. Be extremely careful when removing and replacing

the logic board. Components that contact the enclosure, standoffs, or other modules may cause damage and prevent the iMac from operating correctly.

- Always be careful not to flex the board.
- Always handle the board by the edges. Do not handle the heat sink.



13. Place the logic board in the logic board service tray. For instructions, refer to article [TP1635: Logic Board Service Tray Instructions](#).

Steps For Reassembly

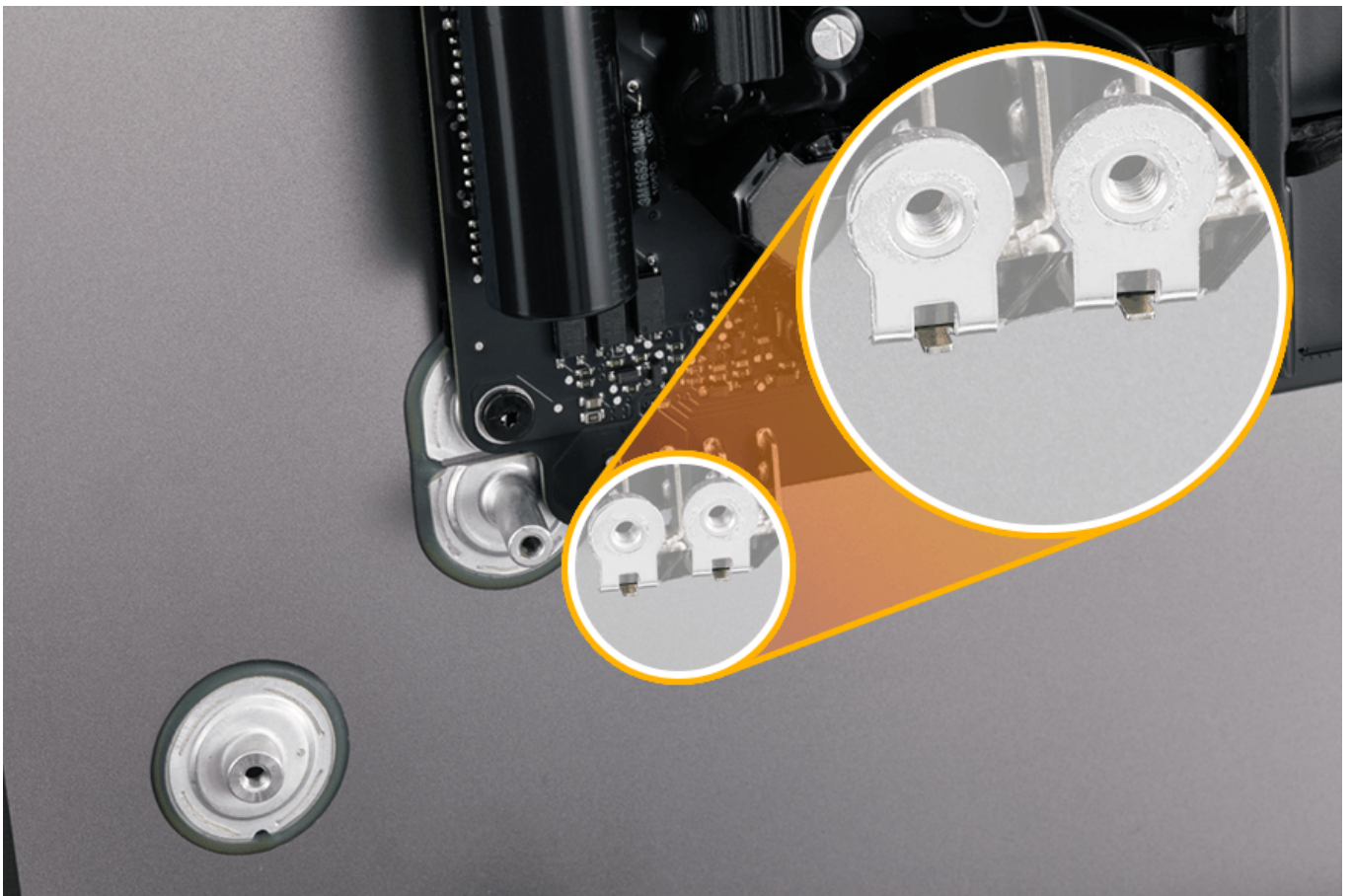
1. If you are installing a replacement logic board, transfer these parts from the old logic board:

- [Memory](#)
- [Flash Storage](#)

Note:

- The logic board and the cards are marked to make sure each is reinstalled in the correct slot.
- The flash storage devices are paired to the logic board and the data cannot be accessed or recovered when installed in another logic board. Make sure the customer has a working backup of their data before removing or replacing the flash storage devices.

2. **Caution:** When reassembling the logic board, be careful not to bend or damage the bus bars on the power supply. If the bus bars are bent they must be replaced. Refer to article [RP1419: Power Supply Bus Bars](#) for instructions on how to replace the bus bars.



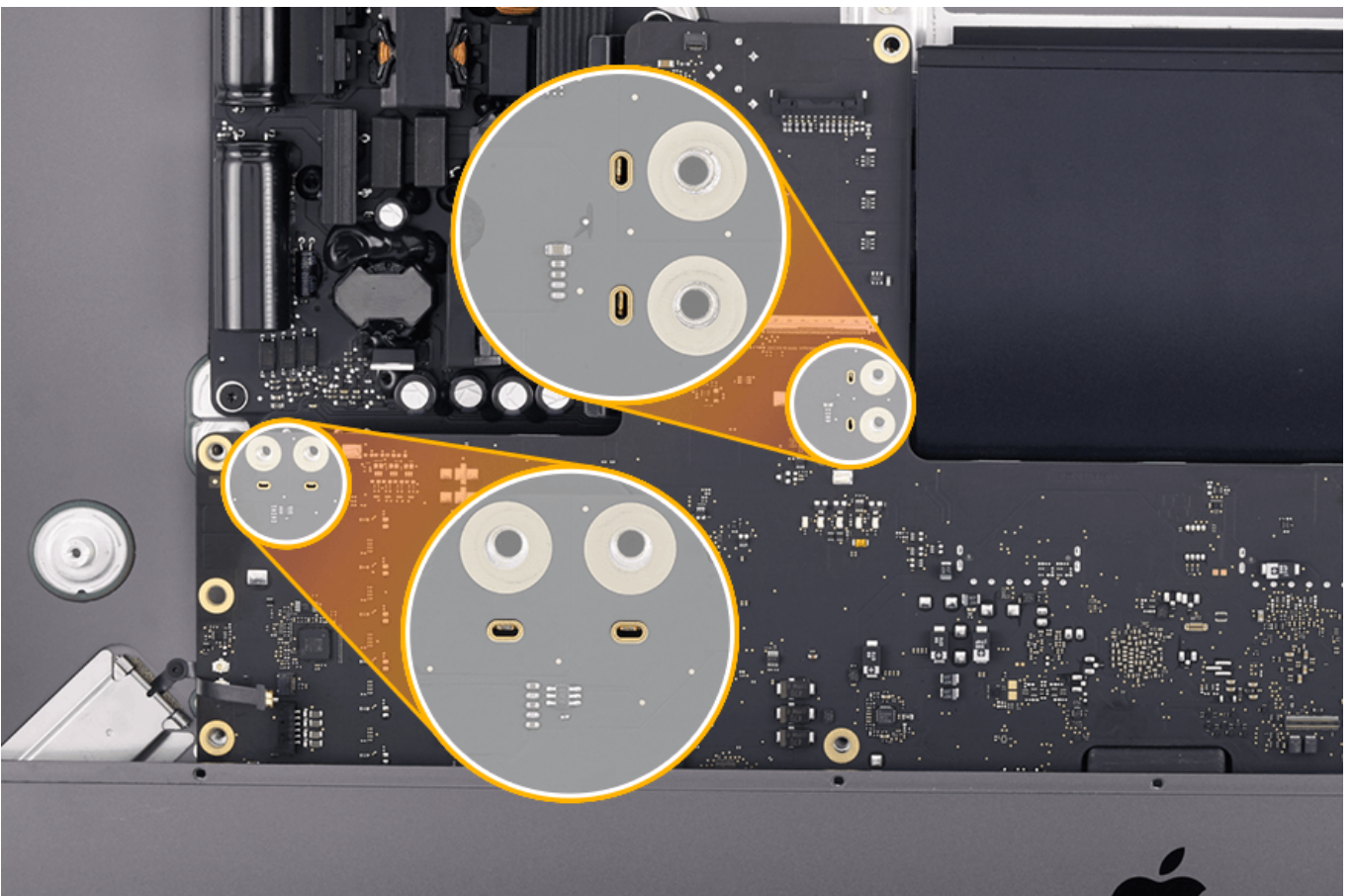
3. With two hands, carefully place the logic board back into the enclosure, again being careful to clear the SD card port on the lower right corner and not to flex the board.

4. To help with alignment, partially reinstall two T8 screws in the upper right corner of the logic board.

Note: A long T8 screw is used in the top middle and a short T8 screw in the top right.



5. Check that the bus bar teeth are visible through the oval holes in the logic board.

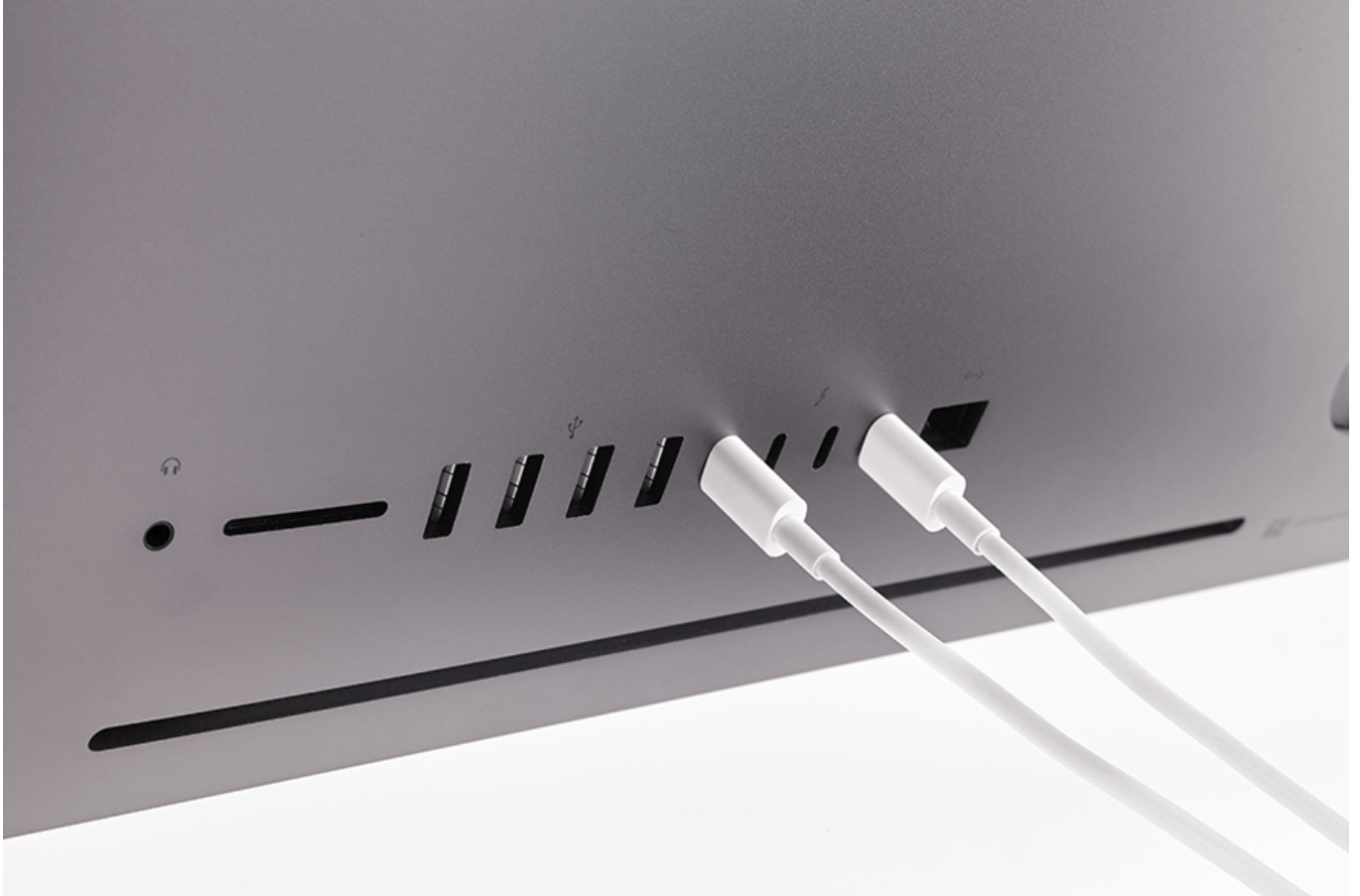


6. Replace the four silver T8 screws with new screws that come with the replacement logic board. Partially install the screws, making sure the teeth are still visible through the holes.

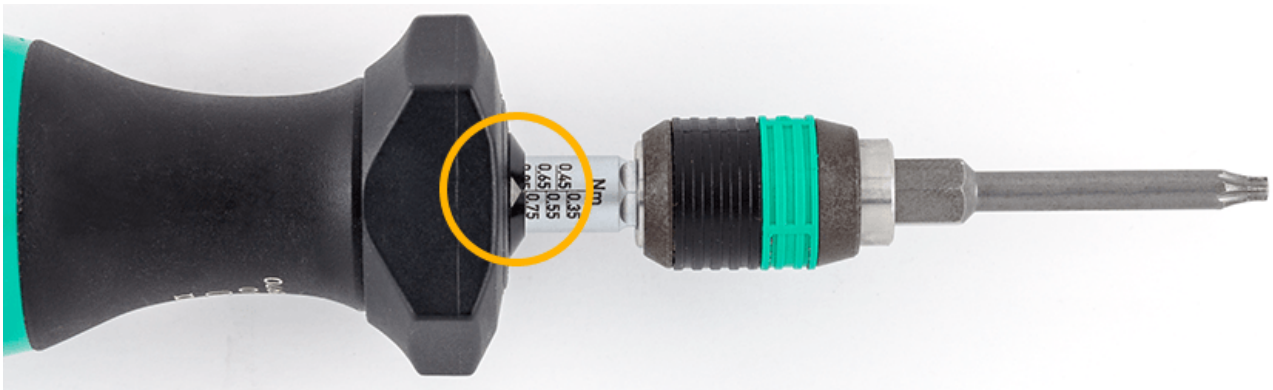
- T8: 923-02288

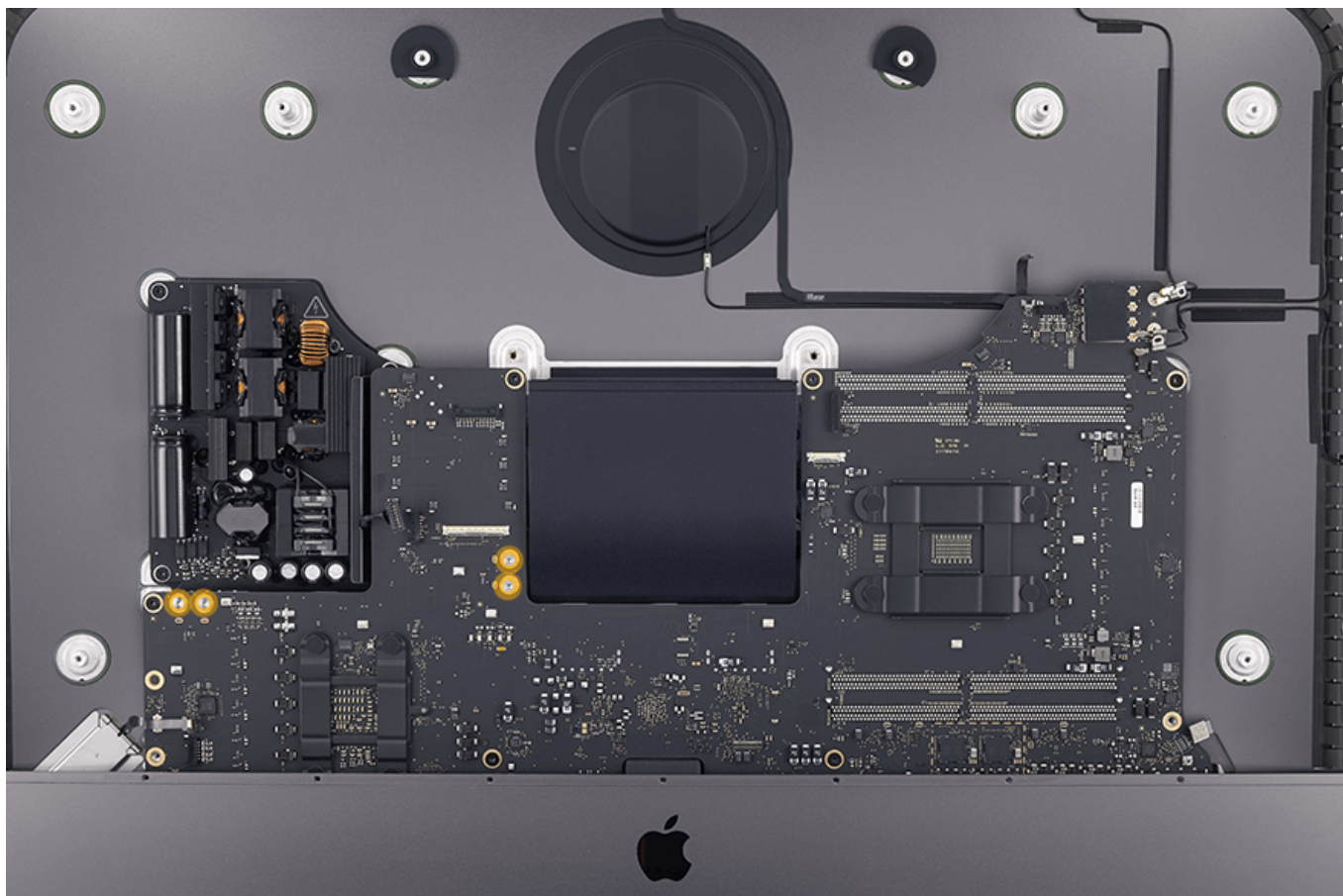


7. To further ensure correct logic board alignment with the rear housing, plug in a USB-C or Thunderbolt 3 cable into two ports before tightening the logic board screws.



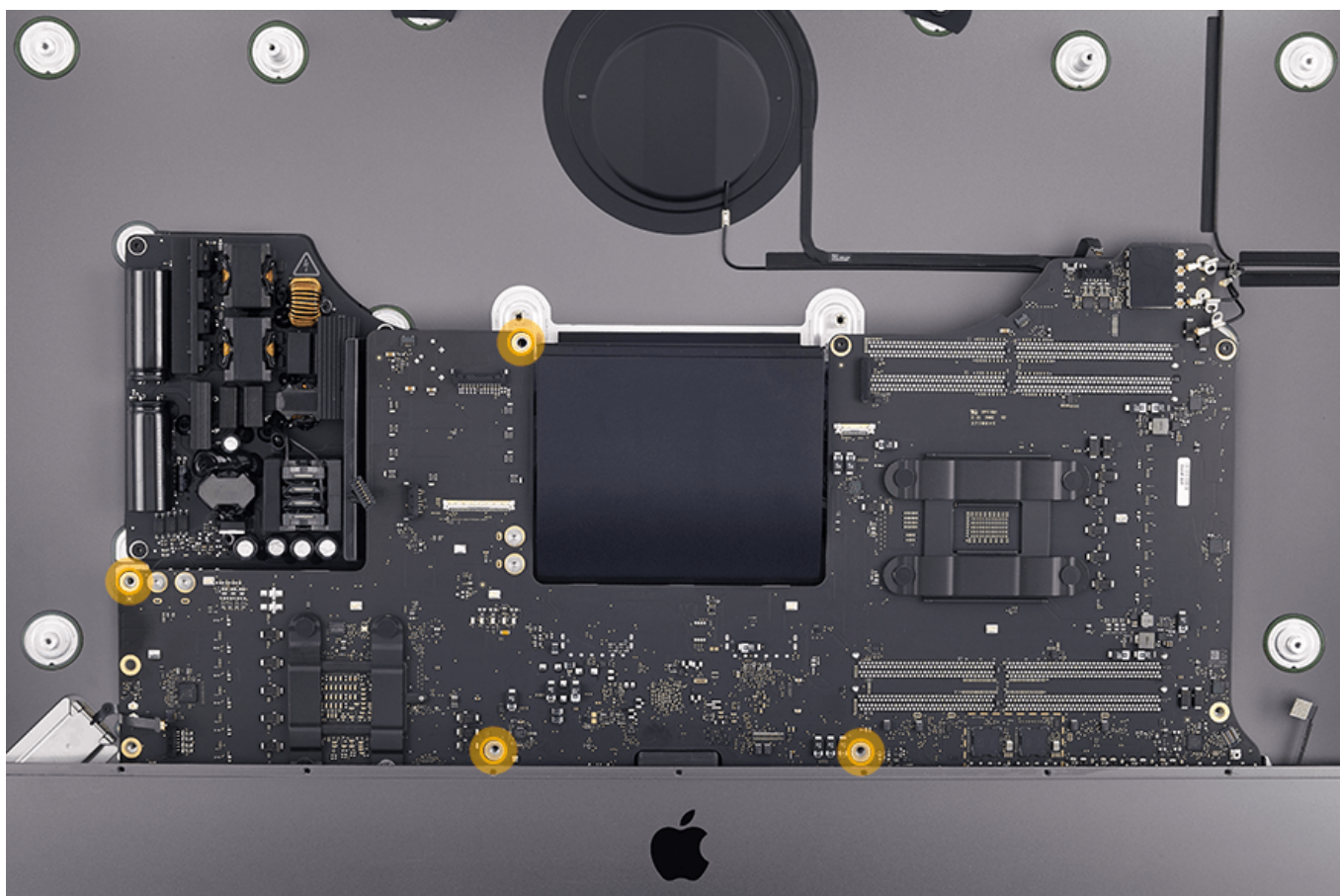
8. Once the alignment is secured, attach the Torx T8 security bit to the adjustable torque driver and tighten the silver T8 logic board screws to 6.6 inch pounds (in.-lb.) or 0.75 Newton metres (N m).





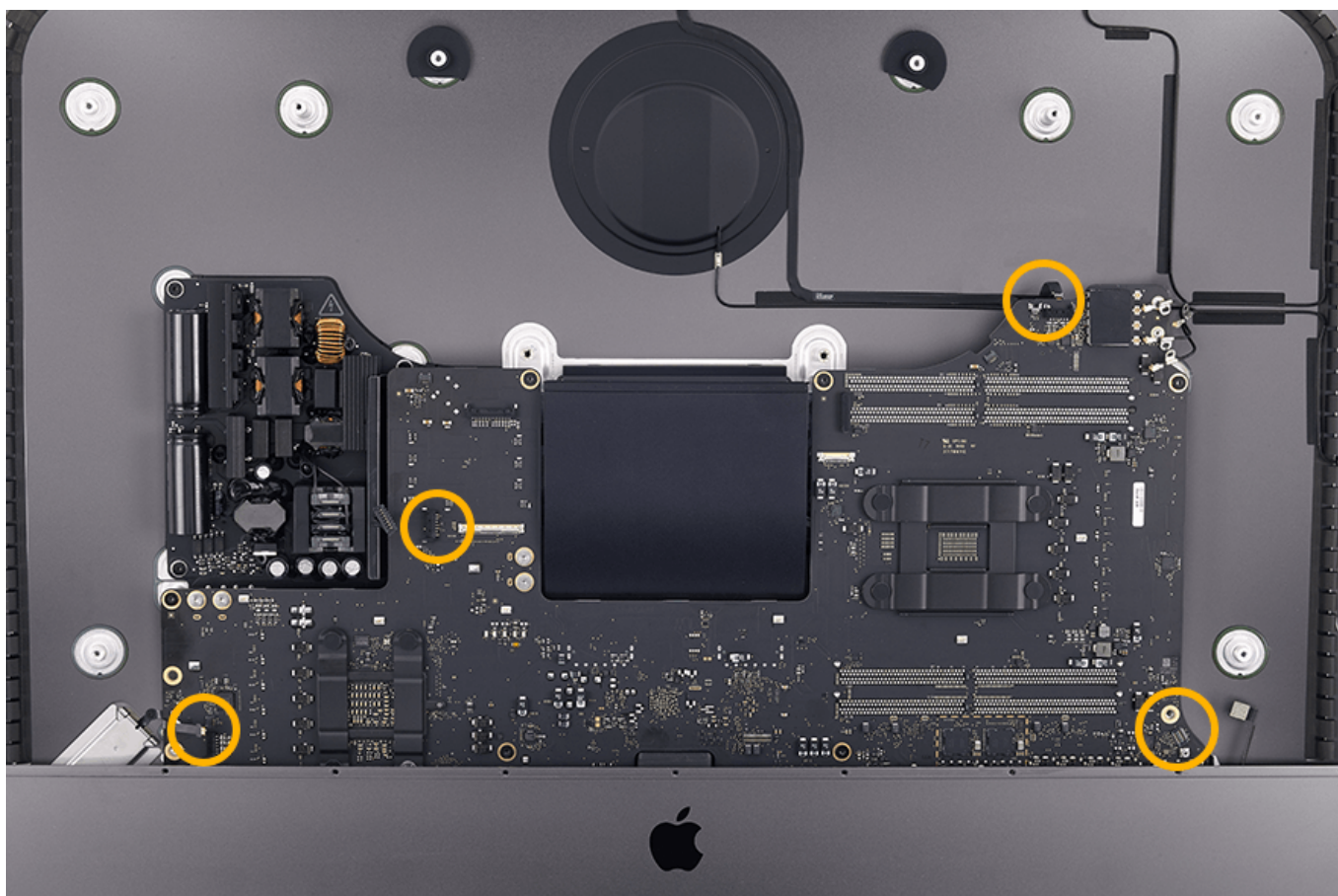
9. Tighten the T8 screws in the upper right of the logic board and reinstall the rest of logic board screws.

Note: A long T8 screw is used in the top middle, the three other screws are short T8 screws.

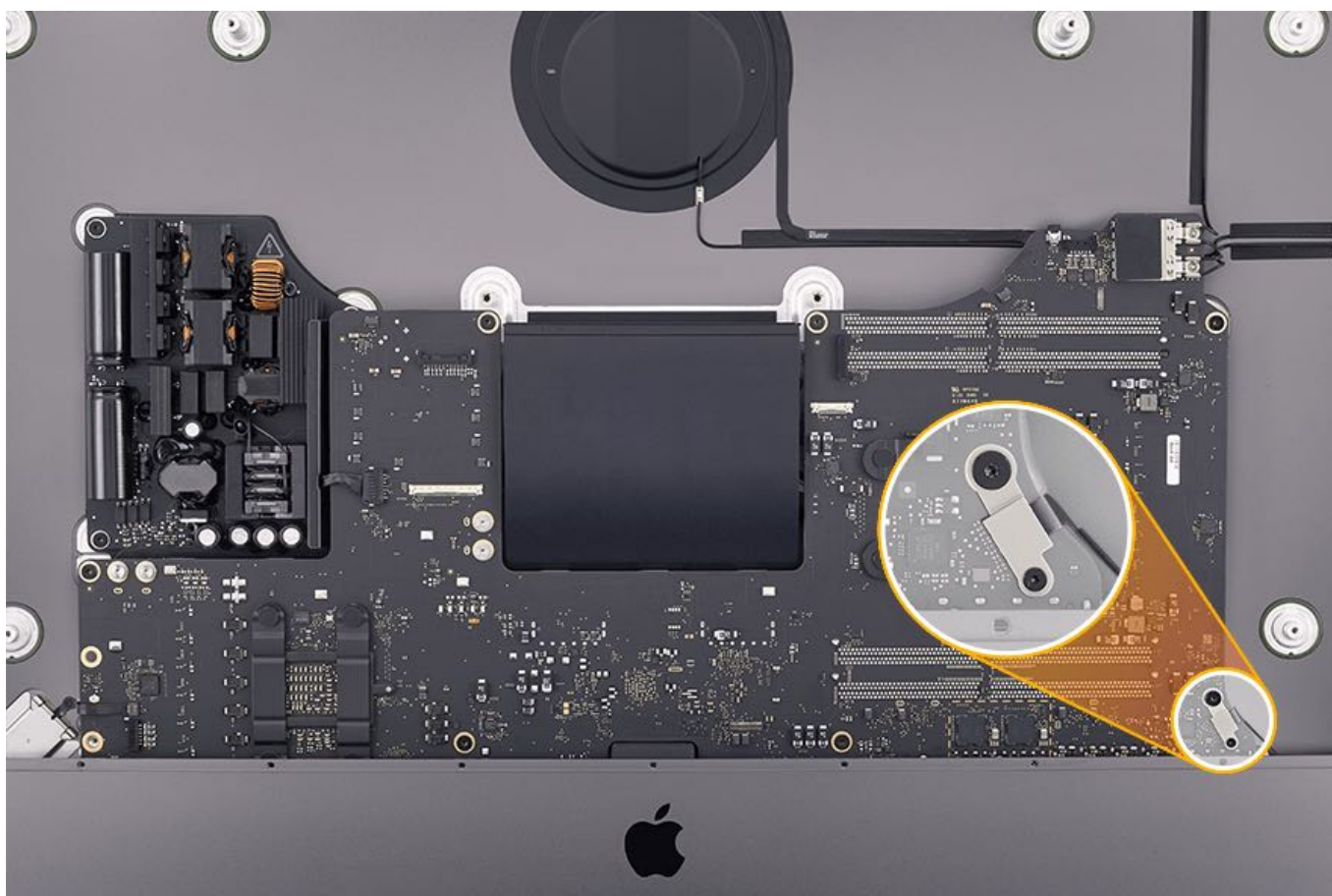


10. Reconnect the microphone, audio, power button, and power supply flex cables to the logic board.

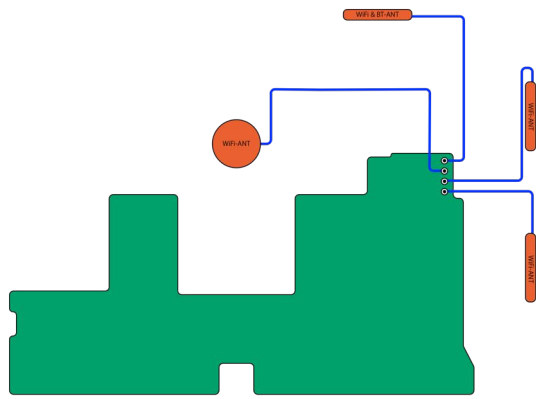
Caution: Be careful not to bend or damage the power button flex cable. Damage to this cable will require a rear housing replacement.



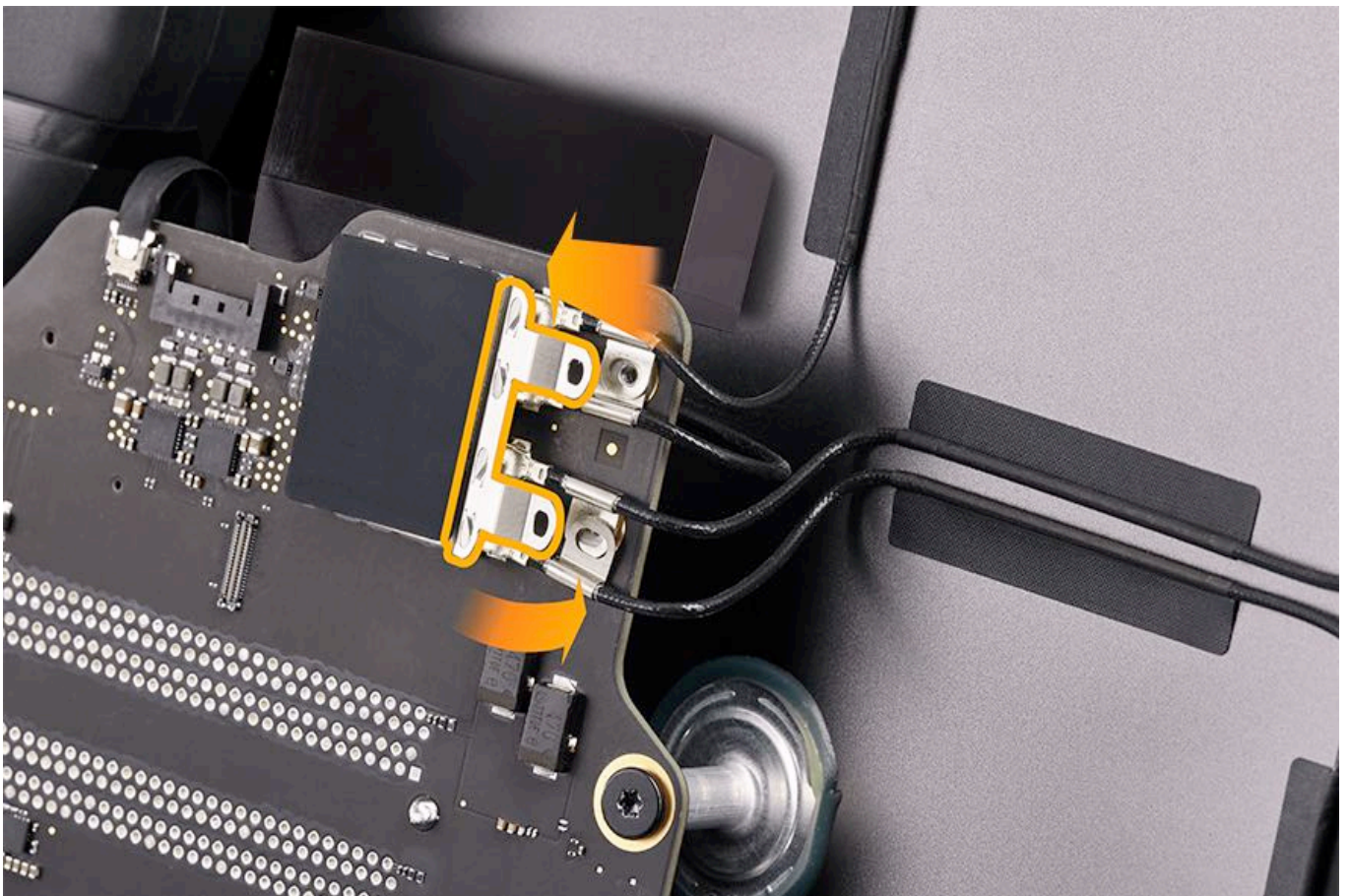
11. Reinstall the cowling over the audio jack flex cable in the lower right corner. Secure the cowling by reinstalling the T8 and T5 screws.



12. To protect the antennas, slide the wireless card support tool (923-02218) into place between the rear housing and the wireless card. Reconnect the antennas to the wireless card using the antenna tool or ESD-safe tweezers.



13. Reinstall the antenna clip. Replace at an angle to engage the teeth, then lay flat and reinstall the two T5 screws.



14. Remove the support tool from the rear housing.

15. Reinstall the [left speaker](#).

16. Reinstall the [right speaker](#).

17. Reinstall the [chin strap](#).

18. Reinstall the [dual fan assembly](#).

19. Install new [display panel VHB strips](#).

20. Reinstall the [display panel](#).

Caution: If a replacement logic board has been installed, Mac Configuration Utility must be run. Refer to article [TP1625: How to use Mac Configuration Utility](#).

Logic Board Service Tray Instructions

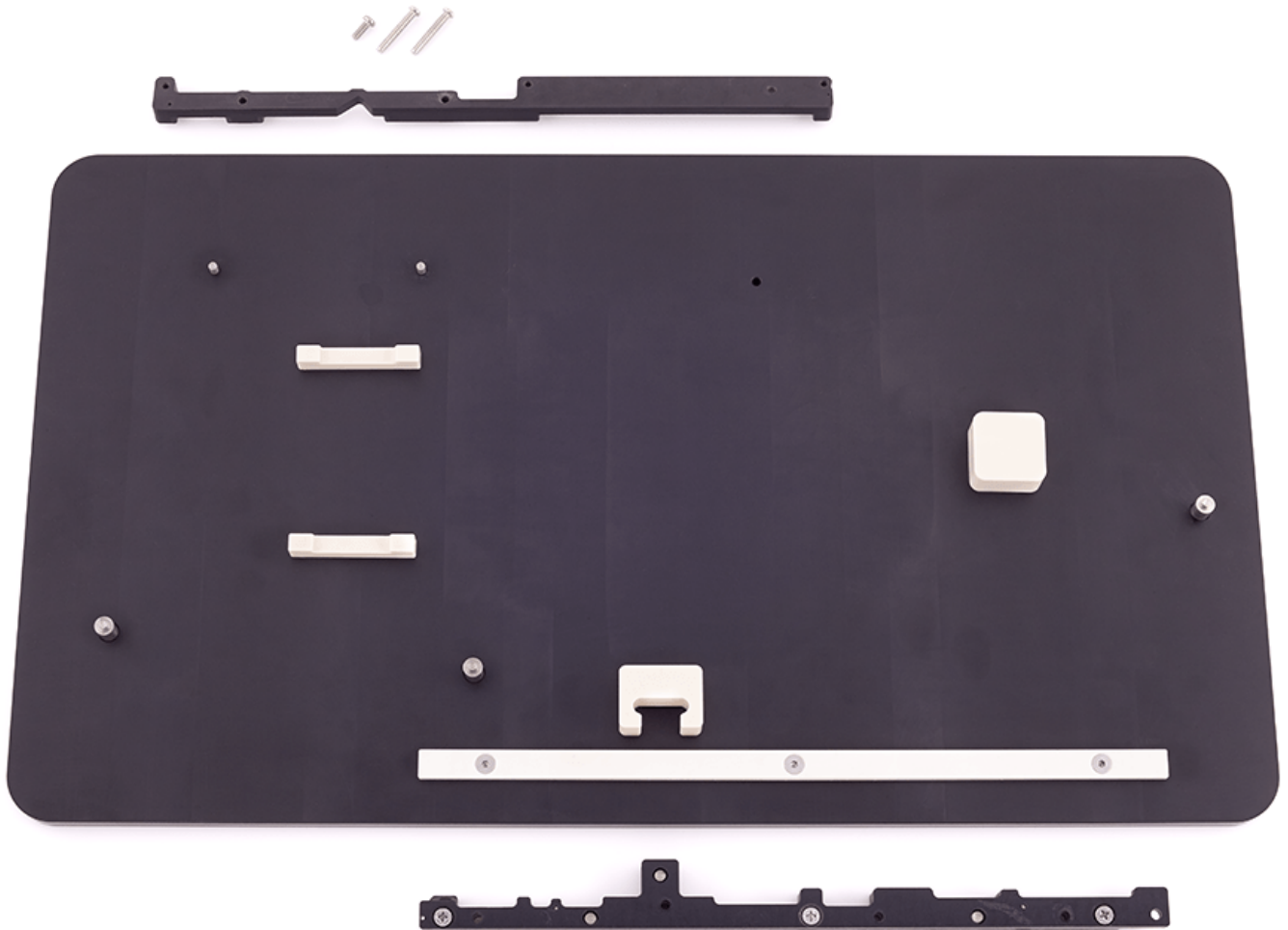
The logic board service tray must be used for the following repair procedures:

- [Logic Board](#)
- [Memory](#)
- [Flash Storage](#)
- [Battery](#)

Note: The logic board service tray and stiffeners come in two separate kits:

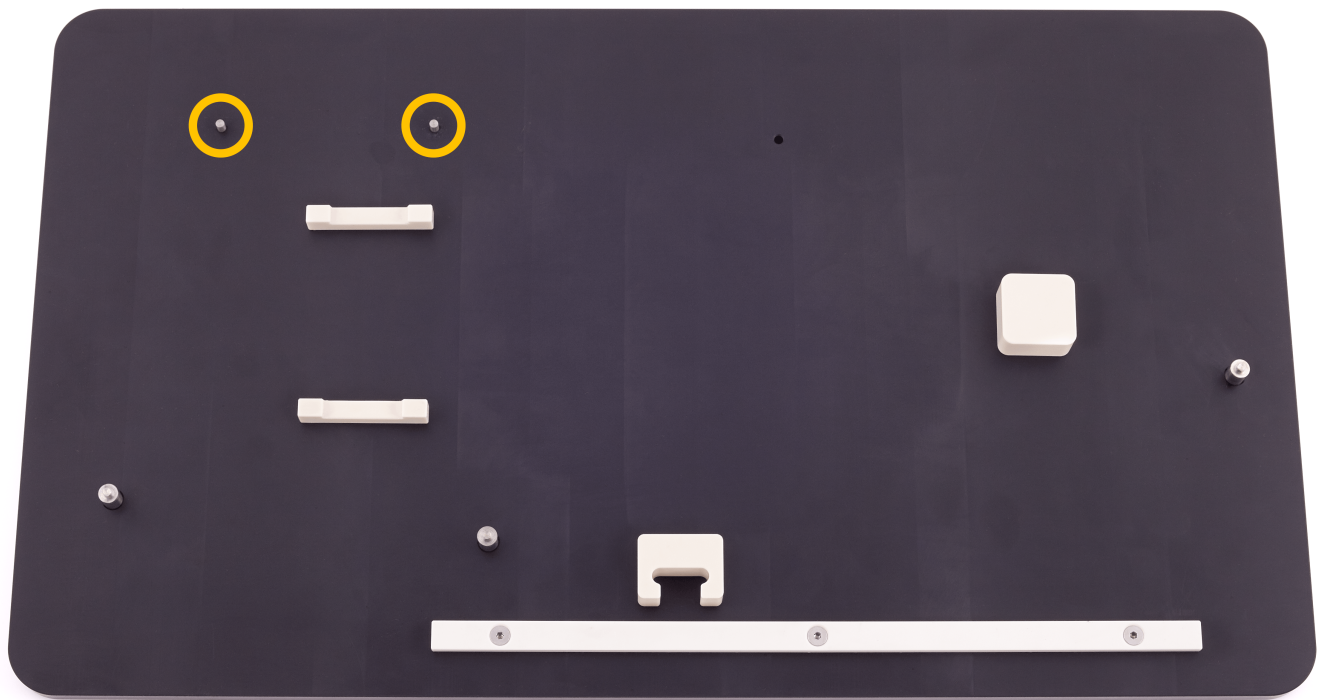
- 076-00376 has the logic board service tray and storage box.
- 923-02217 has the single stiffener and the dual stiffener with six Phillips screws.

Both stiffeners are returned with a known-bad board (KBB). Replacement logic boards include replacement stiffeners.

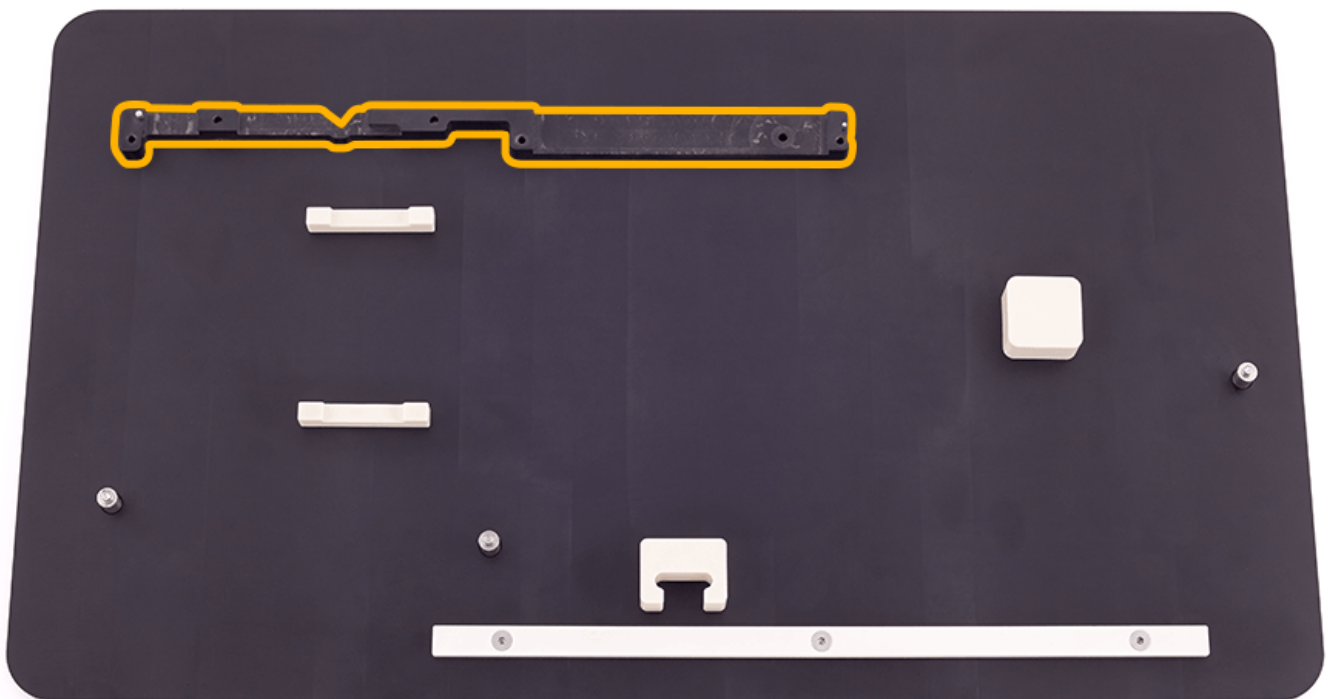


Follow these steps to use the service tray:

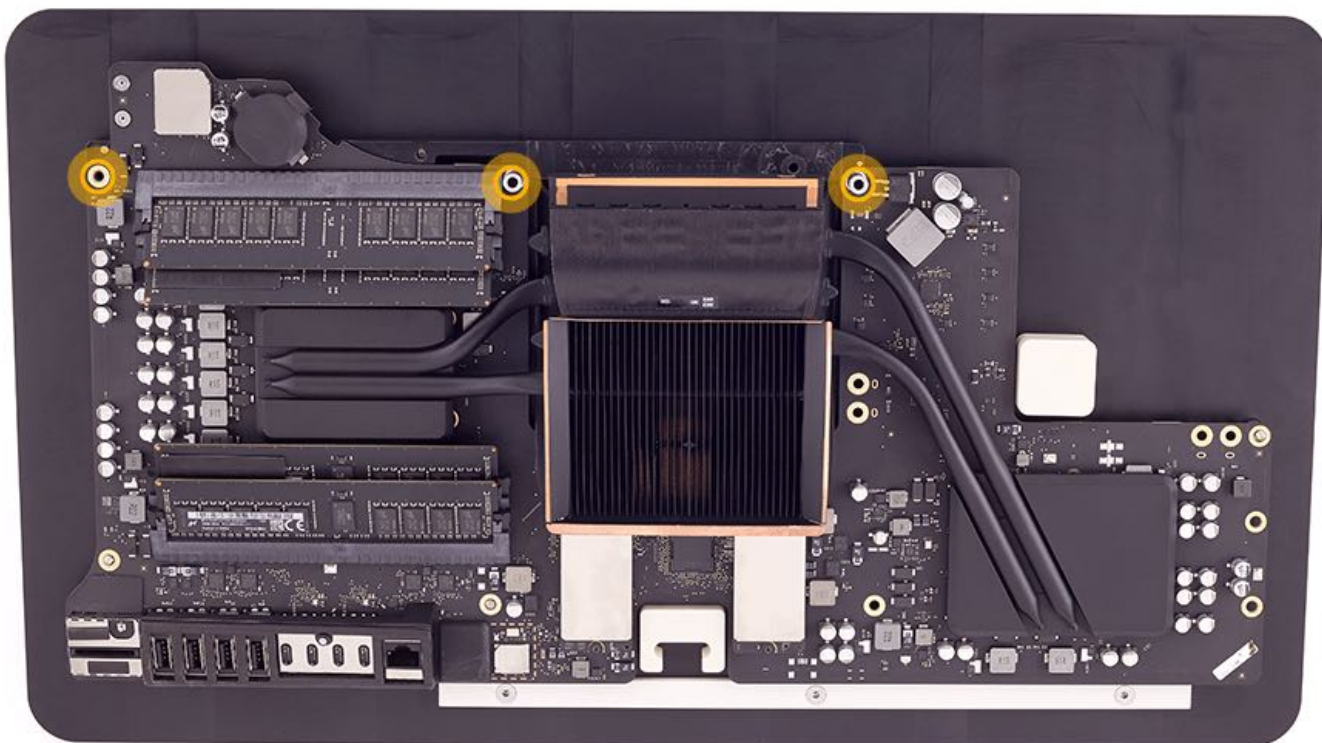
1. Line up the single stiffener with the pins on the tray.



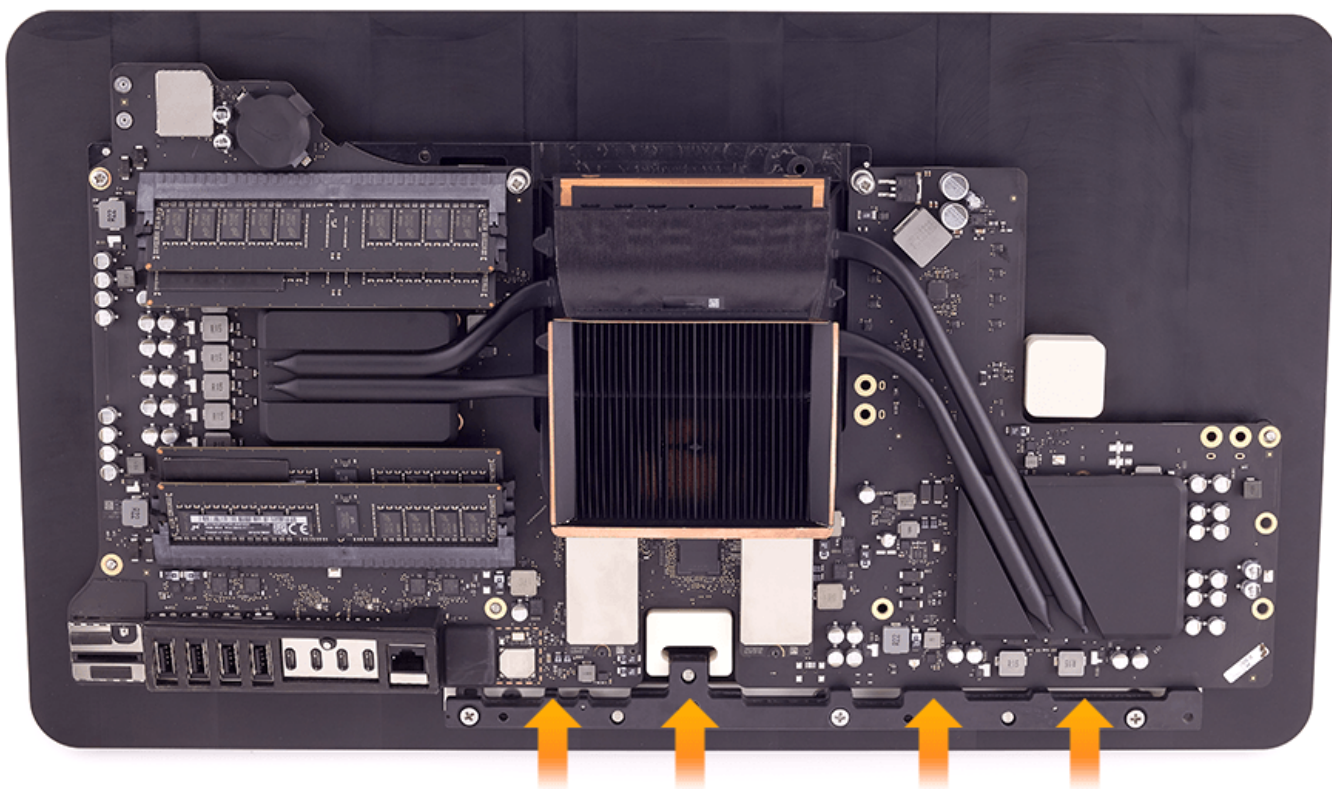
2. Place the single stiffener on the tray.



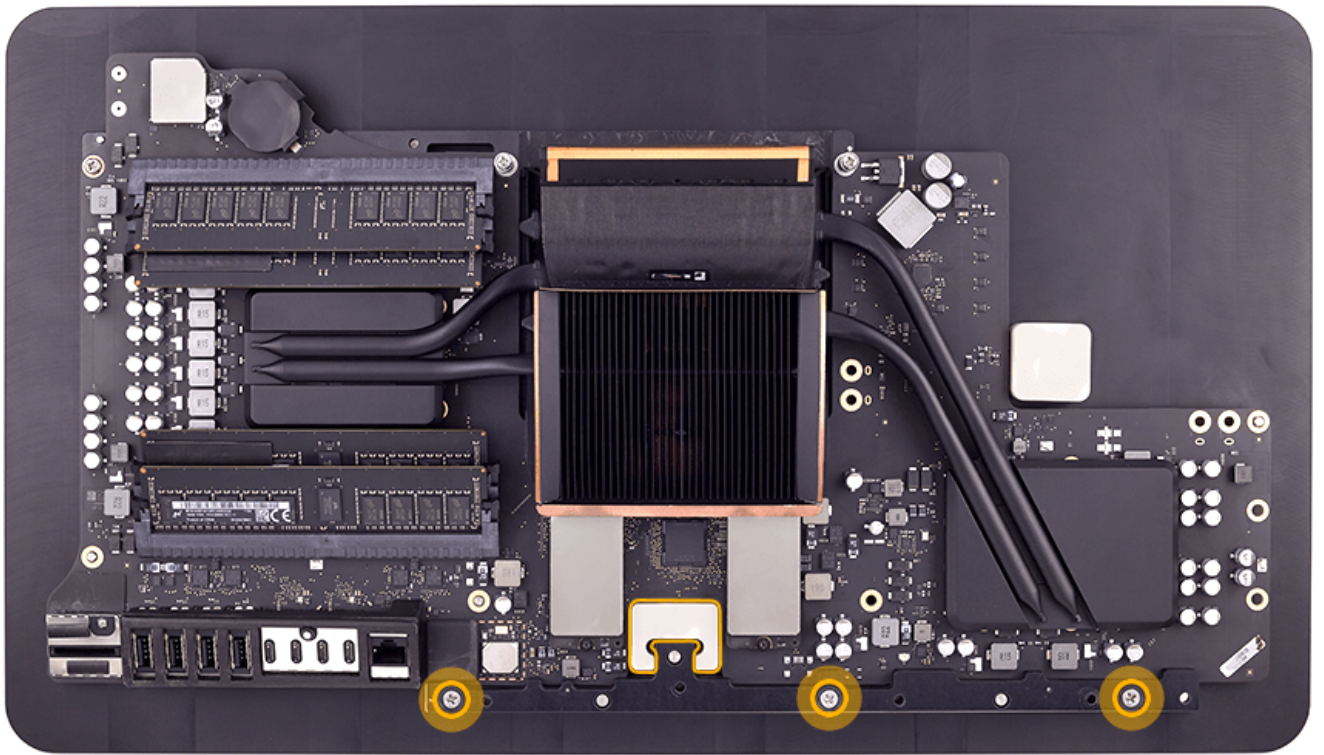
3. Place the logic board on the tray using the white blocks as a guide. Install the three Phillips head screws using an adjustable torque driver set to 0.3 Nm and a PH2 bit. As pictured below, the short screw is installed on the left and the long screws in the standoffs.



4. Slide the dual stiffener onto the logic board. Notice the board is sandwiched between the two halves of the dual stiffener.



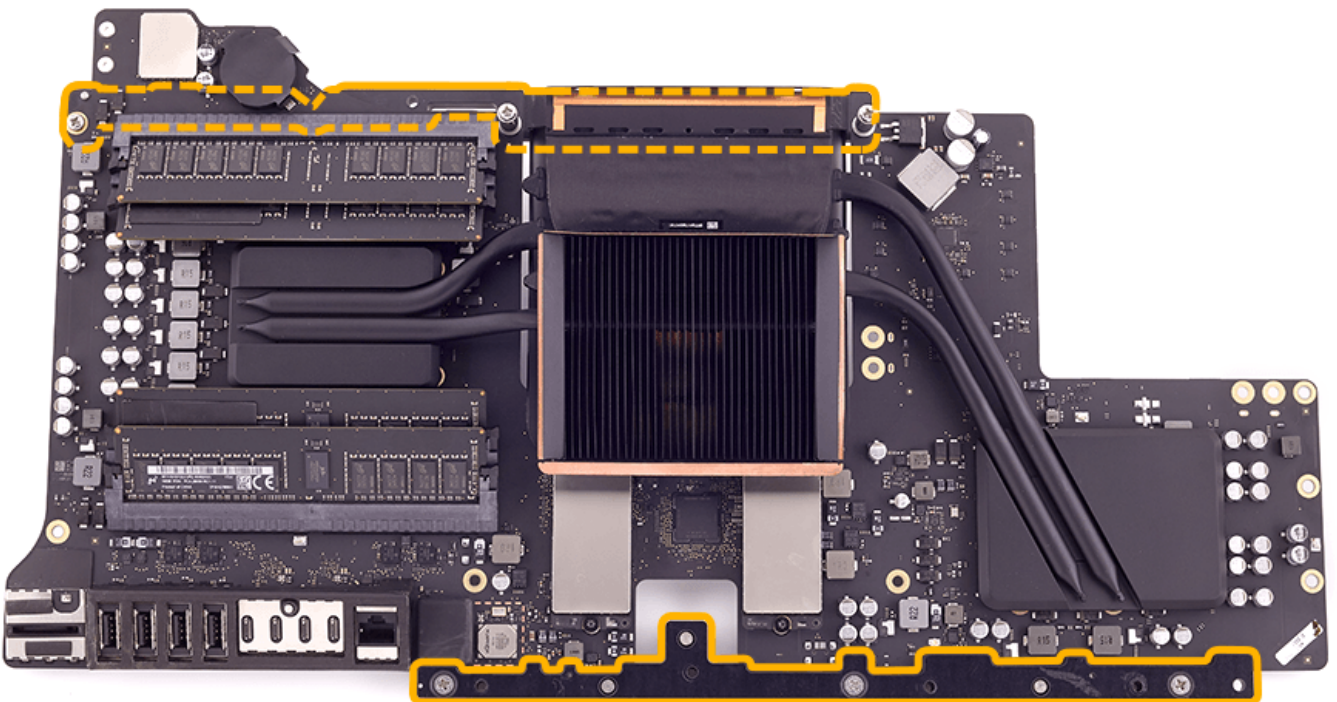
5. Hold the block for leverage and tighten the middle screw first. Then tighten the right and left screws. **Note:** The screws act as captive screws and are not meant to be removed from the dual stiffener.



6. Now that the logic board is secure, the memory, flash storage, or battery can be serviced.

7. After service is complete, remove the stiffeners and reinstall the [logic board](#).

8. If a KBB is being returned, lift the board off of the tray with the stiffeners still intact and ship the KBB with the stiffeners on. Replacement logic boards include replacement stiffeners.



Flash Storage

First Steps



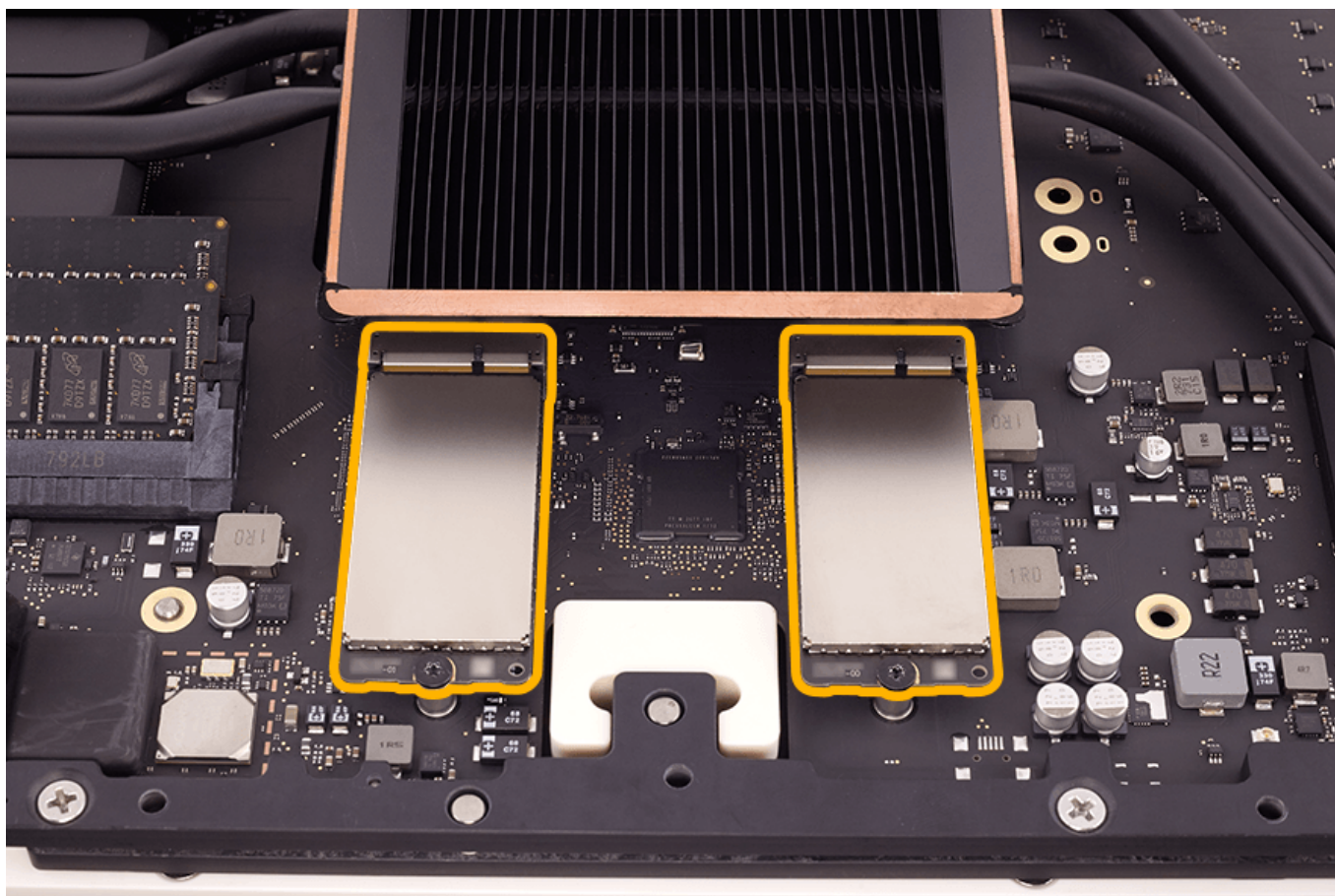
Caution: The flash storage devices are paired to the logic board and the data cannot be accessed or recovered when installed in another logic board. Make sure the customer has a working backup of their data before removing or replacing the flash storage devices.

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

For video instruction, refer to article [SV367: Flash Storage and Memory Replacement Video](#).

Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)
- [Dual Fan Assembly](#)
- [Chin Strap](#)
- [Right Speaker](#)
- [Left Speaker](#)
- [Logic Board](#)



Tools

- ESD wrist strap and mat
- T8 security bit
- Adjustable torque driver 0.3–1.2 N m (923-0735)



Steps For Removal



Caution:

- The flash storage devices are paired to the logic board and the data cannot be accessed or recovered when installed in another logic board. Make sure the customer has a working backup of their data before removing or replacing the flash storage devices.
- The iMac Pro (2017) will not start up after a logic board and/or flash storage replacement until the **Mac Configuration Utility (MCU)** is used. MCU is needed to serialize a logic board after a logic board replacement and to configure the flash storage after new flash storage is installed. For instructions on how to use MCU, refer to article [TP1625: How to Use Mac Configuration Utility](#) and service video [SV369: System Configuration after a Logic Board or Flash Storage Repair](#).

Note: To perform this repair, the logic board must be in the logic board service tray. Refer to [TP1635: Logic Board Service Tray Instructions](#).

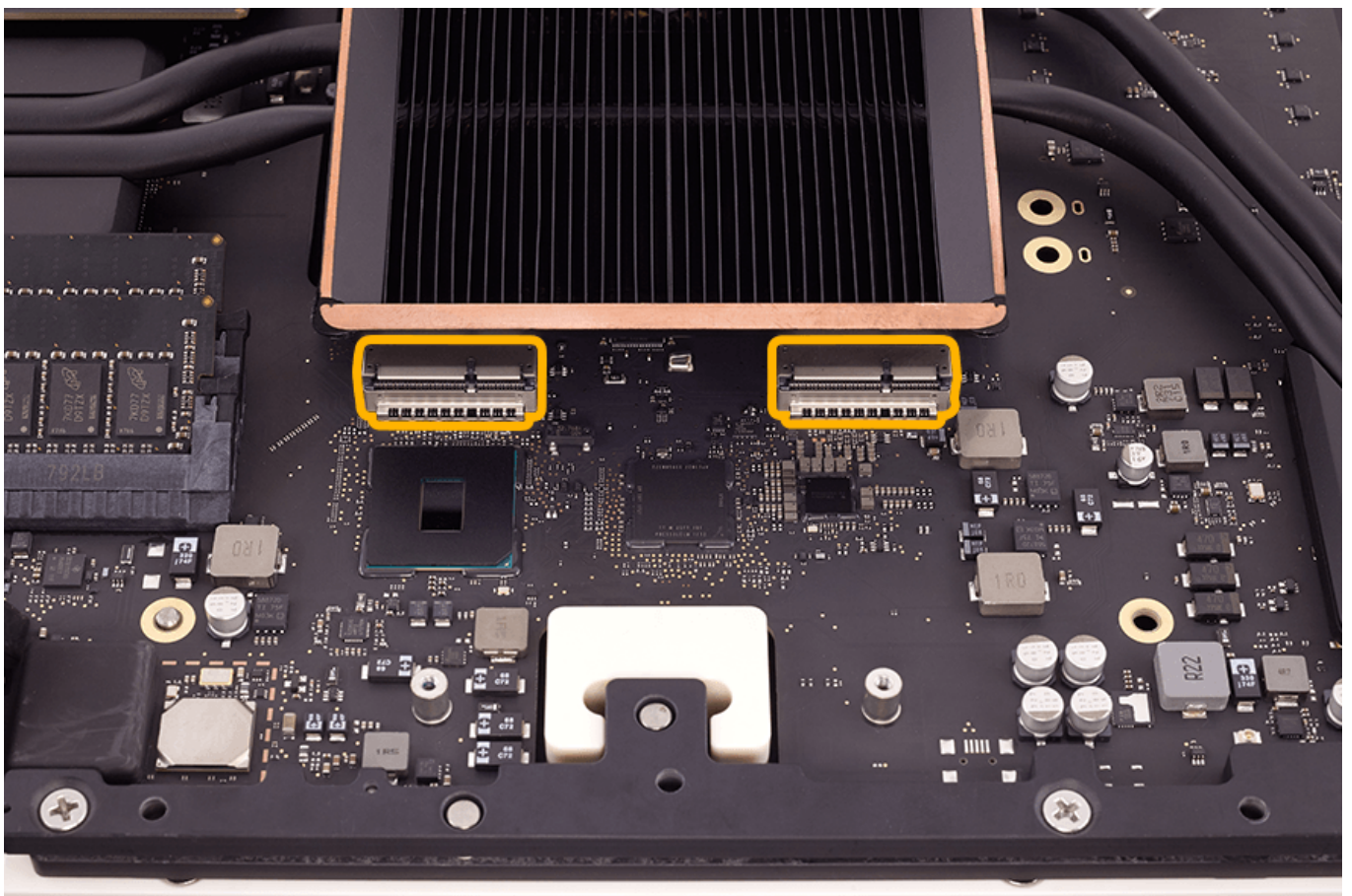
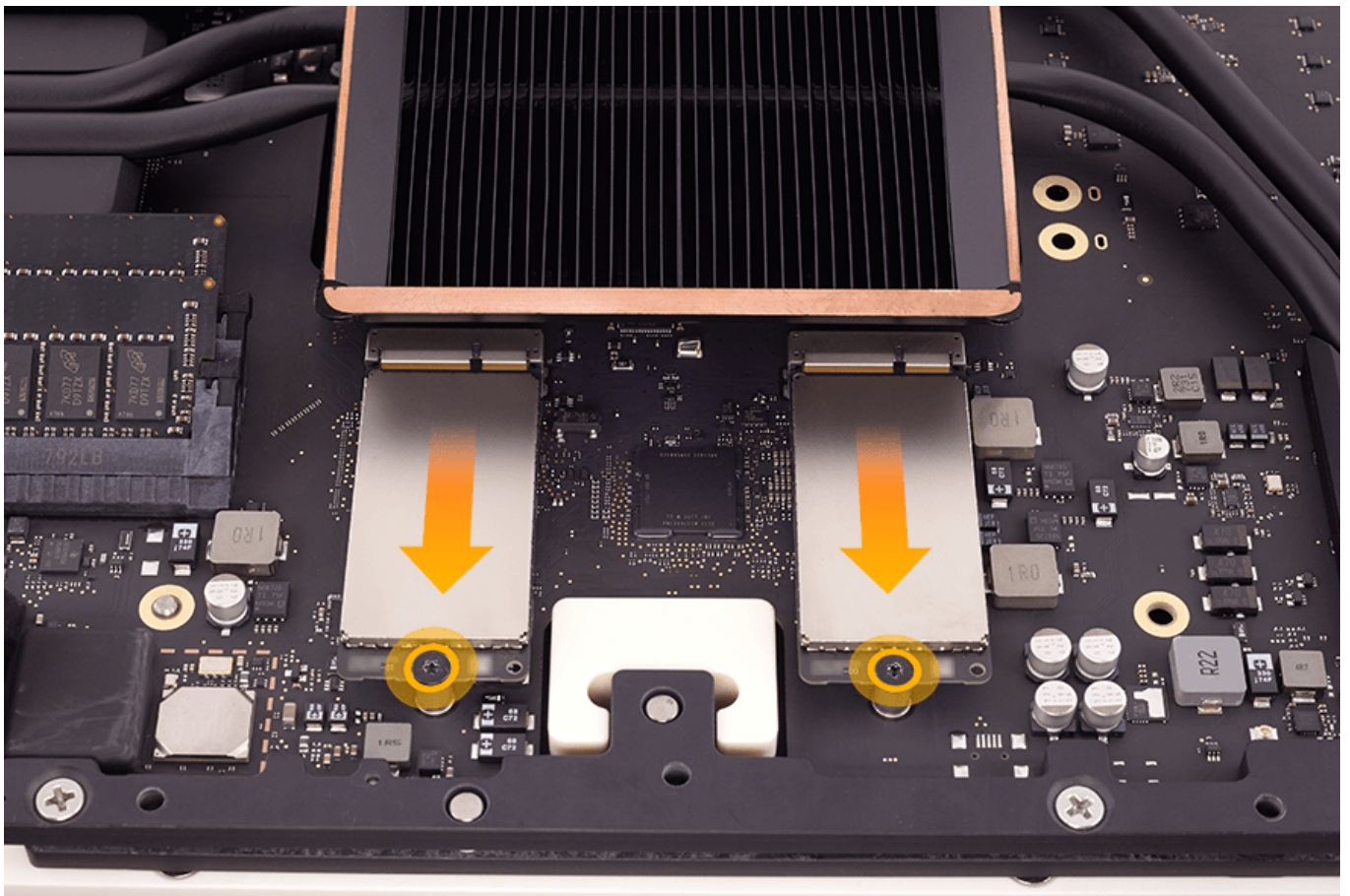
1. Remove one T8 screw from each flash storage card.

- T8: 923-02313



2. Gently pull the flash storage straight out of the connector.

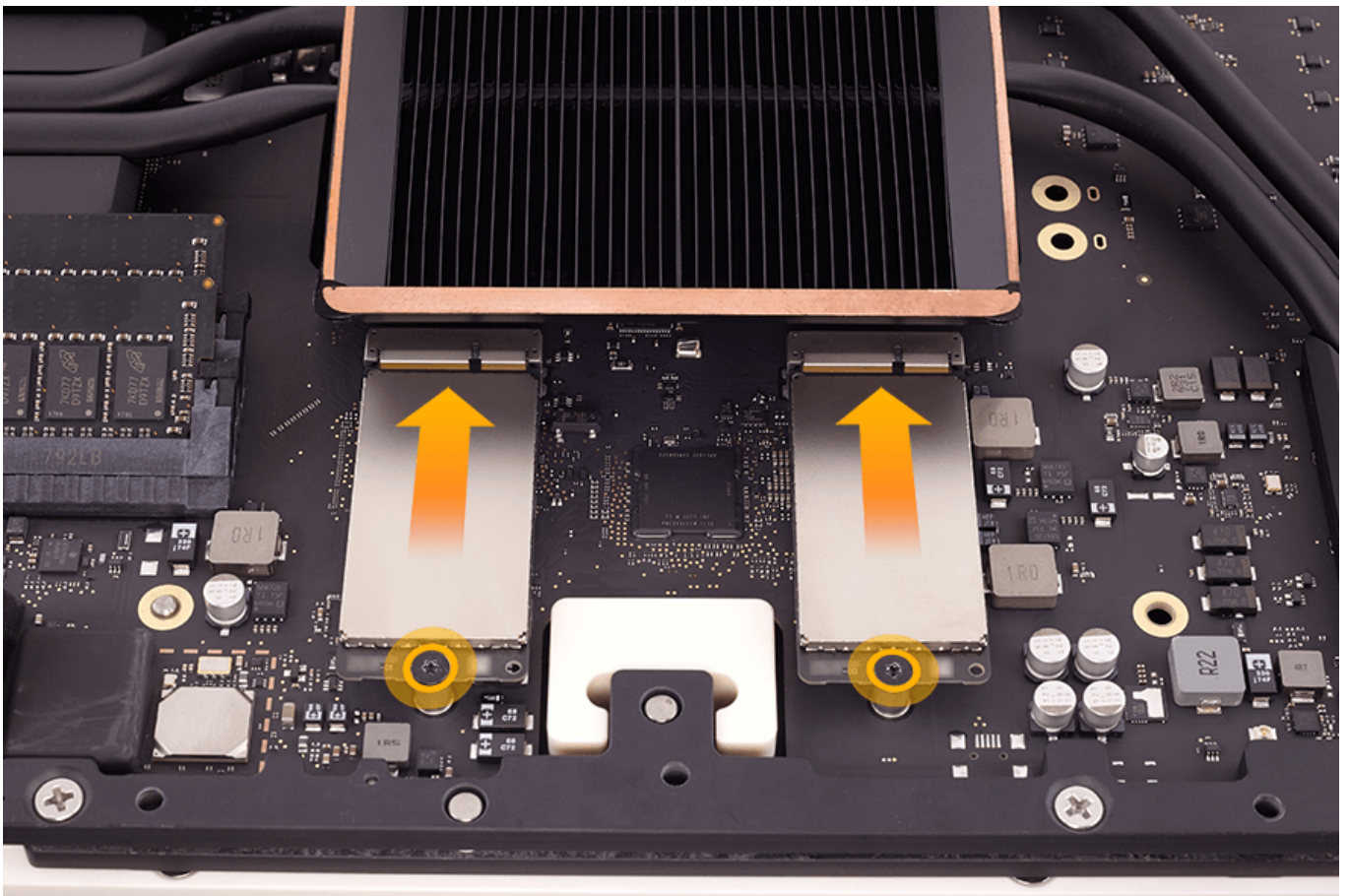
Caution: Do not lift the flash storage at an angle when removing it from the connector. Damage to the connector requires a logic board replacement.



Steps For Reassembly

1. Insert the flash storage straight into the logic board connector.

Note: The flash storage must be reinstalled into the same connector it was taken out of. The flash storage is marked with OO and O1. It is important to remember which slot each card was originally in.



2. Install one T8 screw to each flash storage card. Use the adjustable torque driver to tighten each screw to 2.65 inch pounds (in.-lb.) or 0.3 Newton metres (N m).

- T8: 923-02313



3. Reinstall the [logic board](#).
4. Reinstall the [left speaker](#).
5. Reinstall the [right speaker](#).
6. Reinstall the [dual fan assembly](#).
7. Reinstall the [chin strap](#).
8. Install new [display panel VHB strips](#).
9. Reinstall the [display panel](#).
10. Refer to article [TP767: Reinstalling Software That Came with the Computer](#).

Caution: If replacement flash storage has been installed, Mac Configuration Utility must be run. Refer to article [TP1625: How to use Mac Configuration Utility](#).

Reinstalling Software That Came with the Computer

Reinstalling Software That Came with the Computer

This procedure requires an Internet connection.

Note: In some situations, a user may have set a firmware password. The user must know the firmware password in order to reinstall OS X or macOS. If the user cannot remember the password, then refer to the technician instructions in article [HT204455: How to set a firmware password on your Mac](#).

Important: Apple recommends that users back up their data before any software restore procedure. Back up essential files before installing OS X or macOS. Apple is not responsible for any loss of data. For instructions on using Time Machine, refer to article [HT201250: How to use Time Machine to back up or restore your Mac](#).

For instructions on reinstalling the OS, follow the steps in article [HT204904: How to reinstall macOS](#).

For more information about recovery mode, refer to article [HT201314: About macOS Recovery](#).

Memory

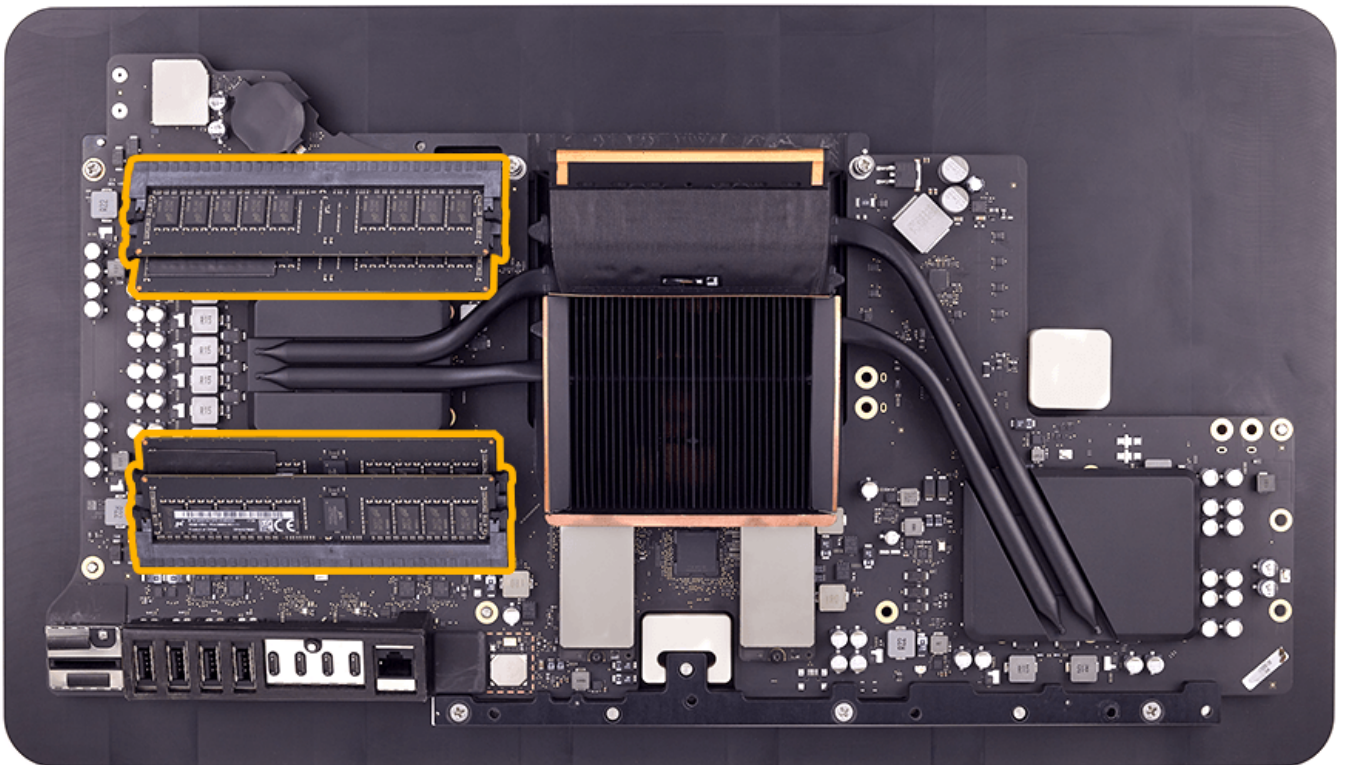
First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

For video instruction, refer to article [SV367: Flash Storage and Memory Replacement Video](#).

Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)
- [Dual Fan Assembly](#)
- [Chin Strap](#)
- [Right Speaker](#)
- [Left Speaker](#)
- [Logic Board](#)



Tools

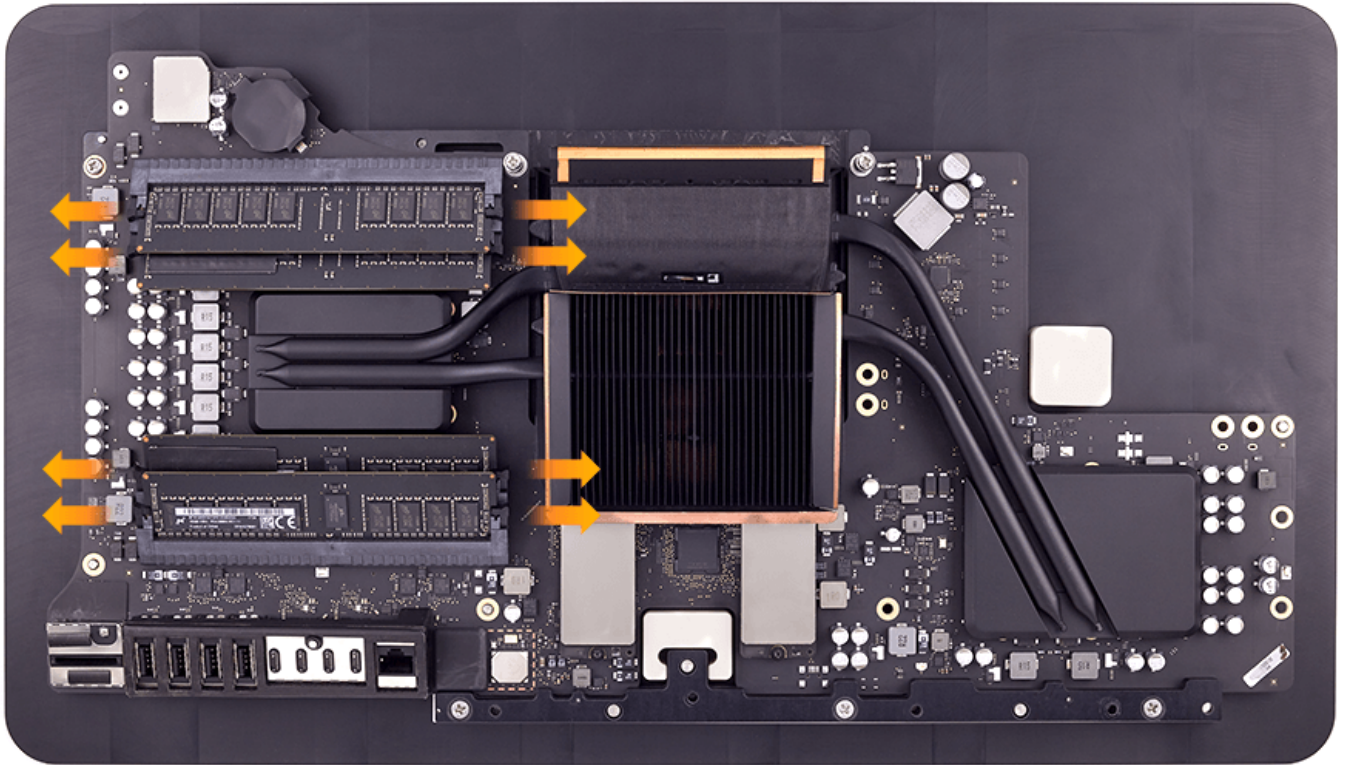
- ESD wrist strap
- Service wedge (iMac)



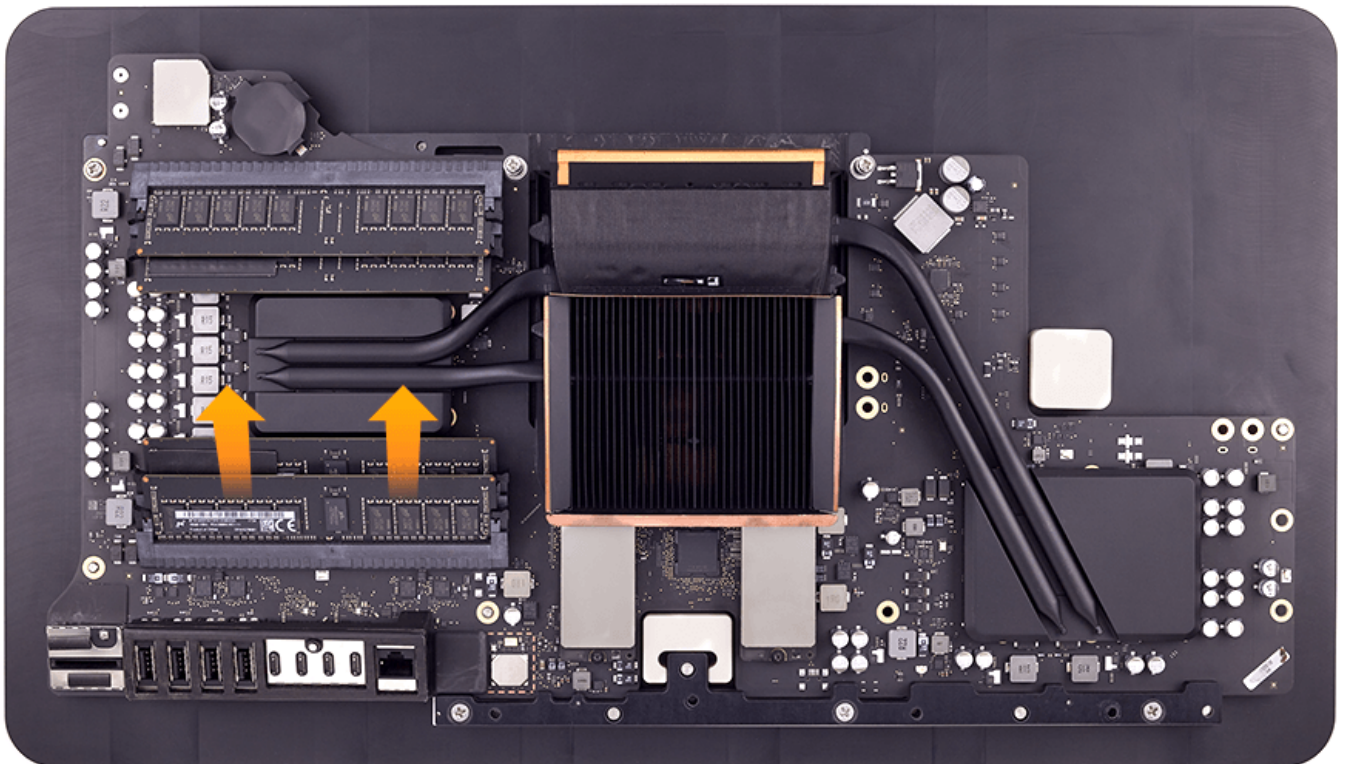
Steps For Removal

Note: To perform this repair, the logic board must be in the logic board service tray. Refer to [TP1635: Logic Board Service Tray Instructions](#).

1. Locate the two levers on the right and left side of the memory slot. Push the levers outward to release the memory.

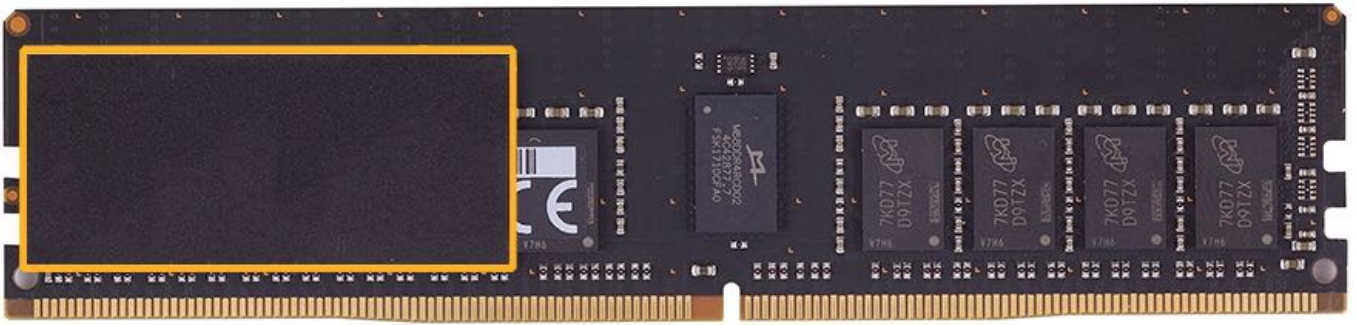


2. Hold the DIMMs by the sides and gently pull straight out in the direction the DIMMs are positioned in the slot. Be careful not to bend the DIMM.



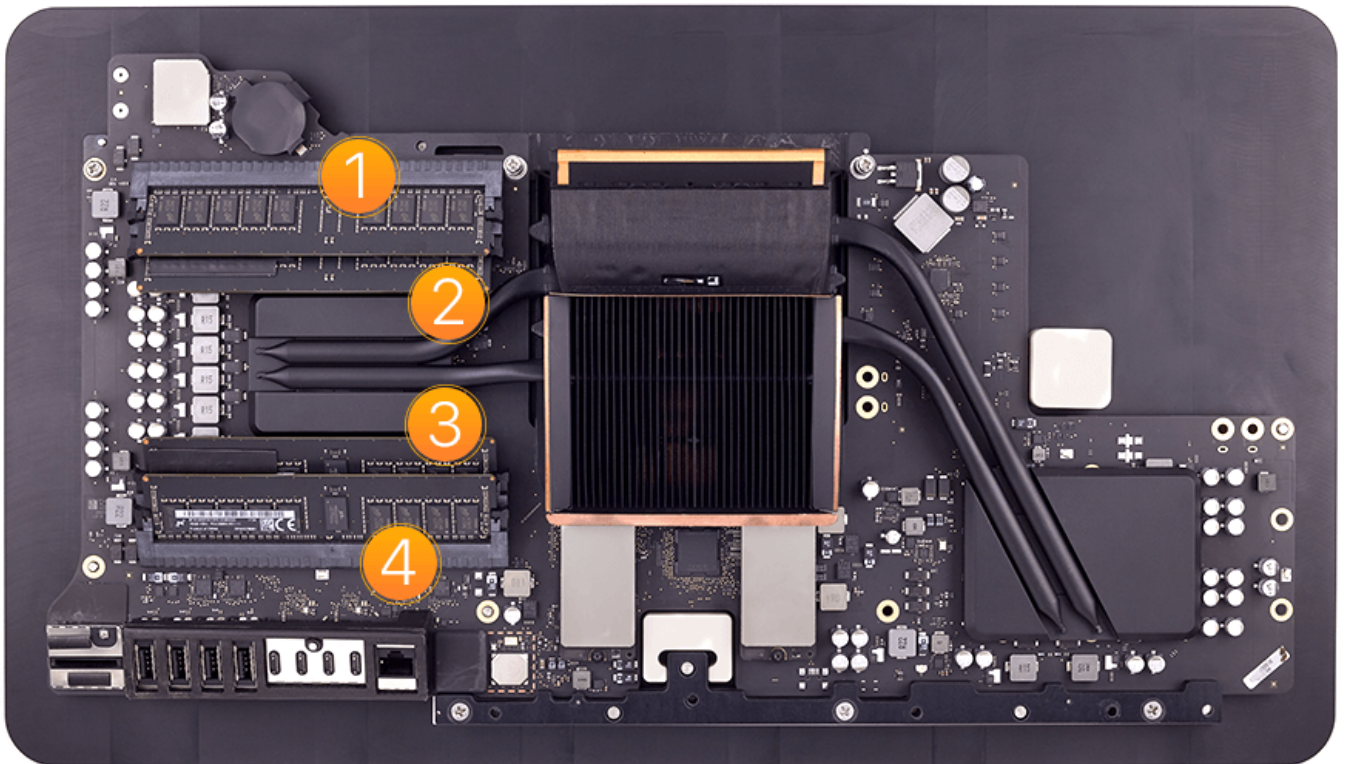
Steps For Reassembly

Note: If you are replacing DIMMS in slots 2 and 4, reinstall a new EMI absorber.



- Remove the protective backing from the new absorber.
- Align one end of the absorber with the notched side of the replacement DIMM. **Note:** Make sure the absorber does not cover the gold pins or the notch.
- Press the absorber onto the DIMM so it is smooth.

Note: One absorber is included with each replacement DIMM service part. However, third-party DIMMs in slot 2 or 4 also require the absorber. Use part number 923-02311 to order additional absorbers.



1. Make sure the levers on the memory slots are open.
2. Insert the DIMM into the slot. Use both thumbs to press the DIMM into place until both levers latch.
3. Check the slots and make sure the DIMM is fully seated.
4. Reinstall the [logic board](#).
5. Reinstall the [left speaker](#).
6. Reinstall the [right speaker](#).
7. Reinstall the [dual fan assembly](#).
8. Reinstall the [chin strap](#).
9. Install new [display panel VHB strips](#).
10. Reinstall the [display panel](#).

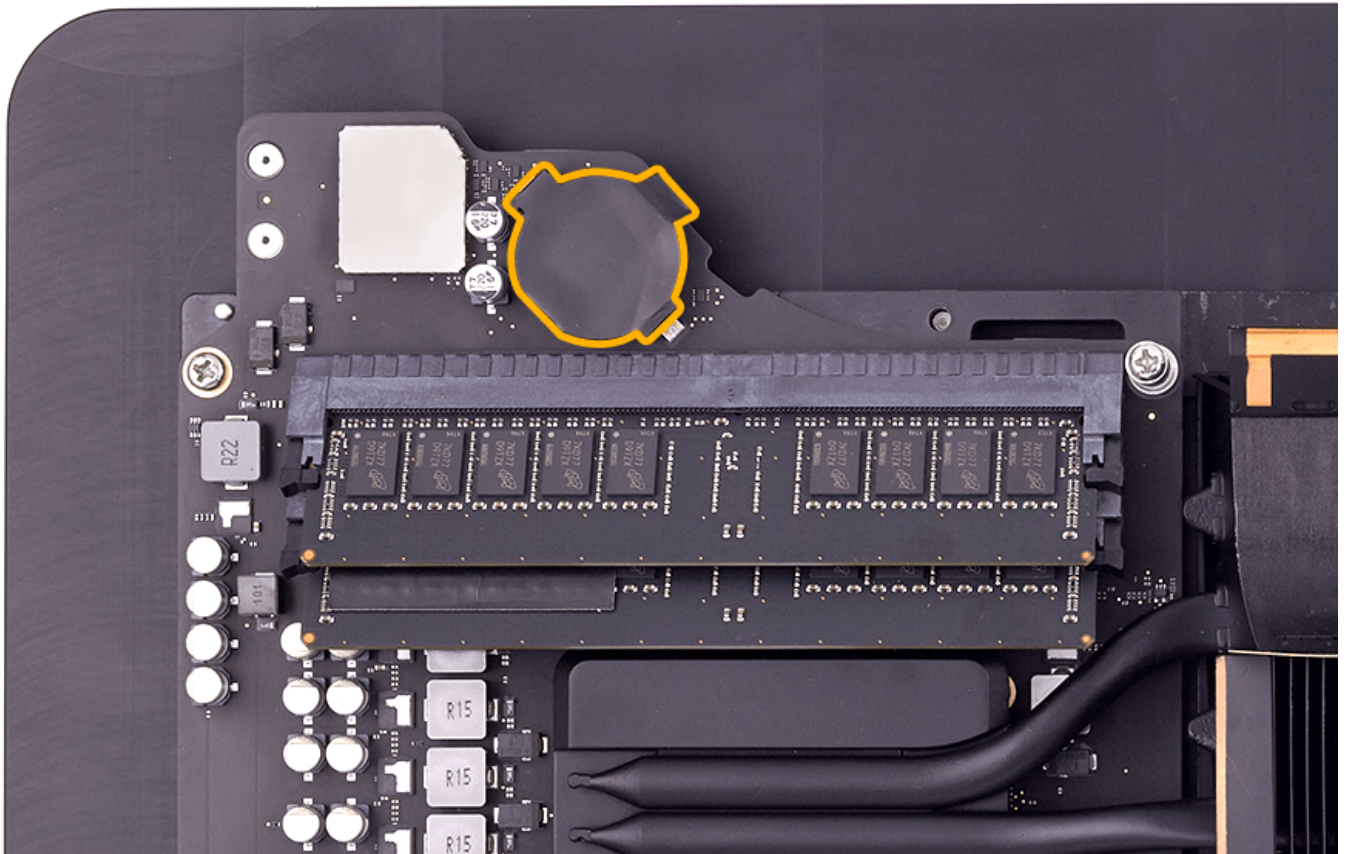
Battery

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

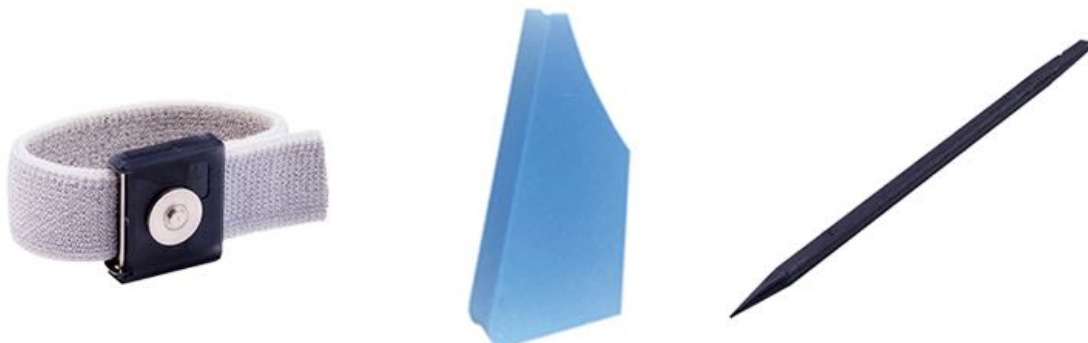
Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)
- [Dual Fan Assembly](#)
- [Chin Strap](#)
- [Right Speaker](#)
- [Left Speaker](#)
- [Logic Board](#)



Tools

- ESD wrist strap
- Service wedge (iMac)
- Black stick

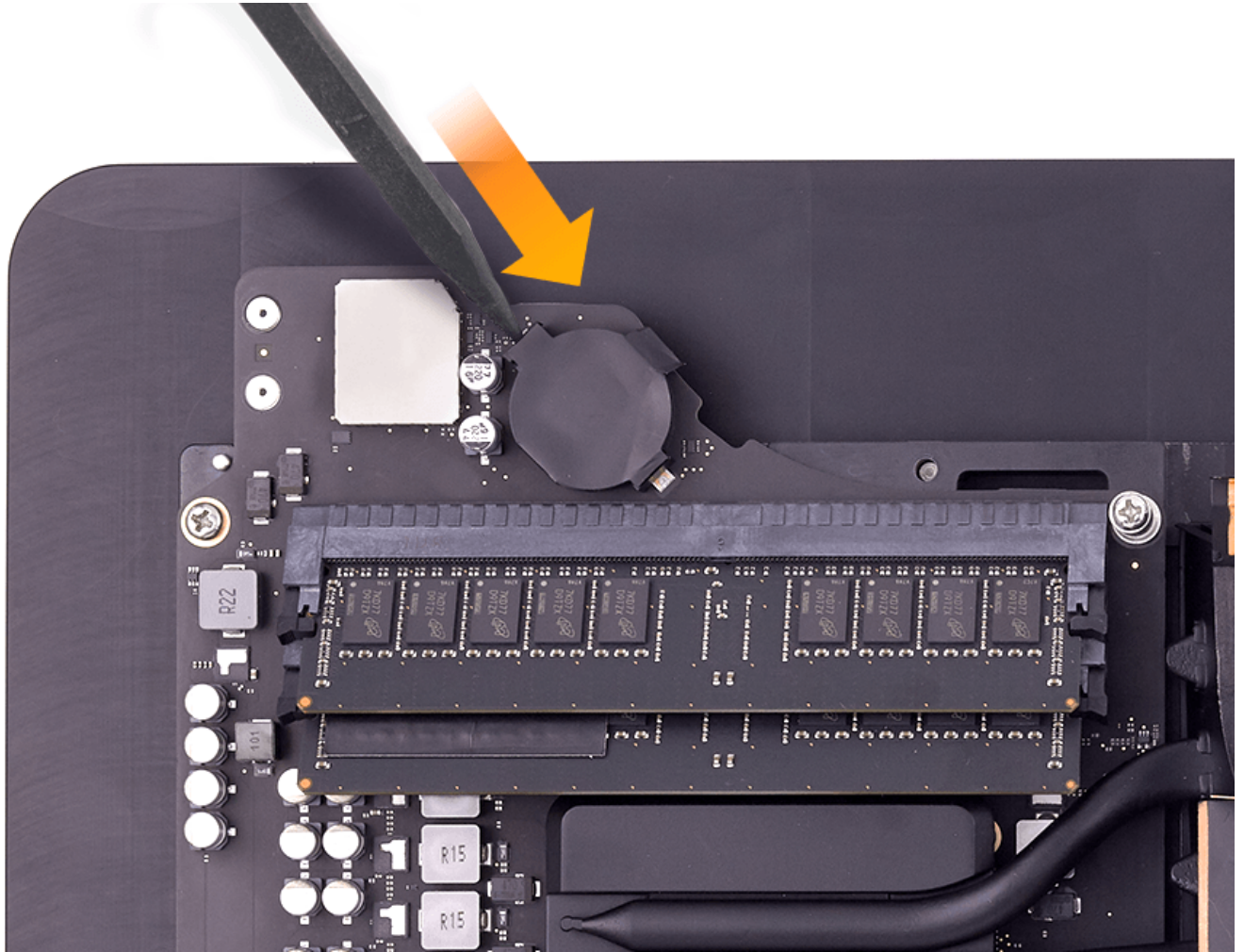


Steps For Removal

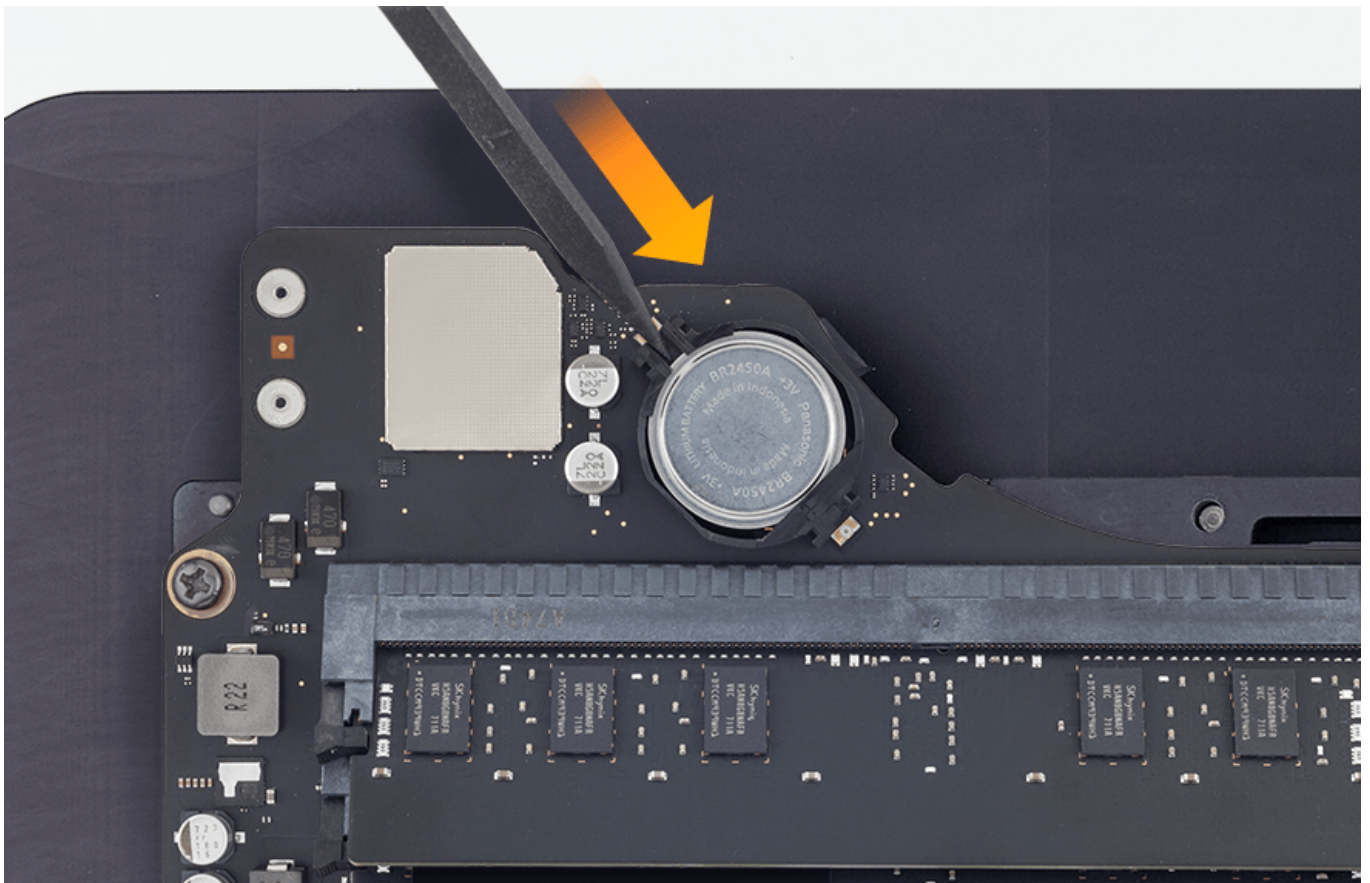
Note: To perform this repair, the logic board must be in the logic board service tray. Refer to [TP1635: Logic Board Service](#)

[Tray Instructions.](#)

1. Remove the protective Mylar from the battery socket.



2. Use your finger to push the battery forward, to open a tiny gap between the battery and the battery socket. Insert the tip of a black stick into the socket and carefully pry the battery out of the socket.



Steps For Reassembly



Warning: If the battery is installed incorrectly or replaced with an incorrect type of battery, there is a risk of explosion. Dispose of used batteries according to local environmental laws and guidelines.

Note: Batteries for iMac Pro (2017) can not be ordered as a service part. If the battery needs to be replaced, the customer can supply their own battery or the battery can be purchased from an outside supplier (BR2450A lithium coin cell battery). When replacing the customer supplied battery, the Mylar must be ordered and replaced at the same time (923-02334).

1. Check that the battery socket on the logic board is open and free of dust.
2. Slide the battery into the socket with engraved markings (+ side) facing up.
3. Reinstall the [logic board](#).
4. Reinstall the [left speaker](#).
5. Reinstall the [right speaker](#).
6. Reinstall the [dual fan assembly](#).
7. Reinstall the [chin strap](#).
8. Install new [display panel VHB strips](#).
9. Reinstall the [display panel](#).

Power Supply

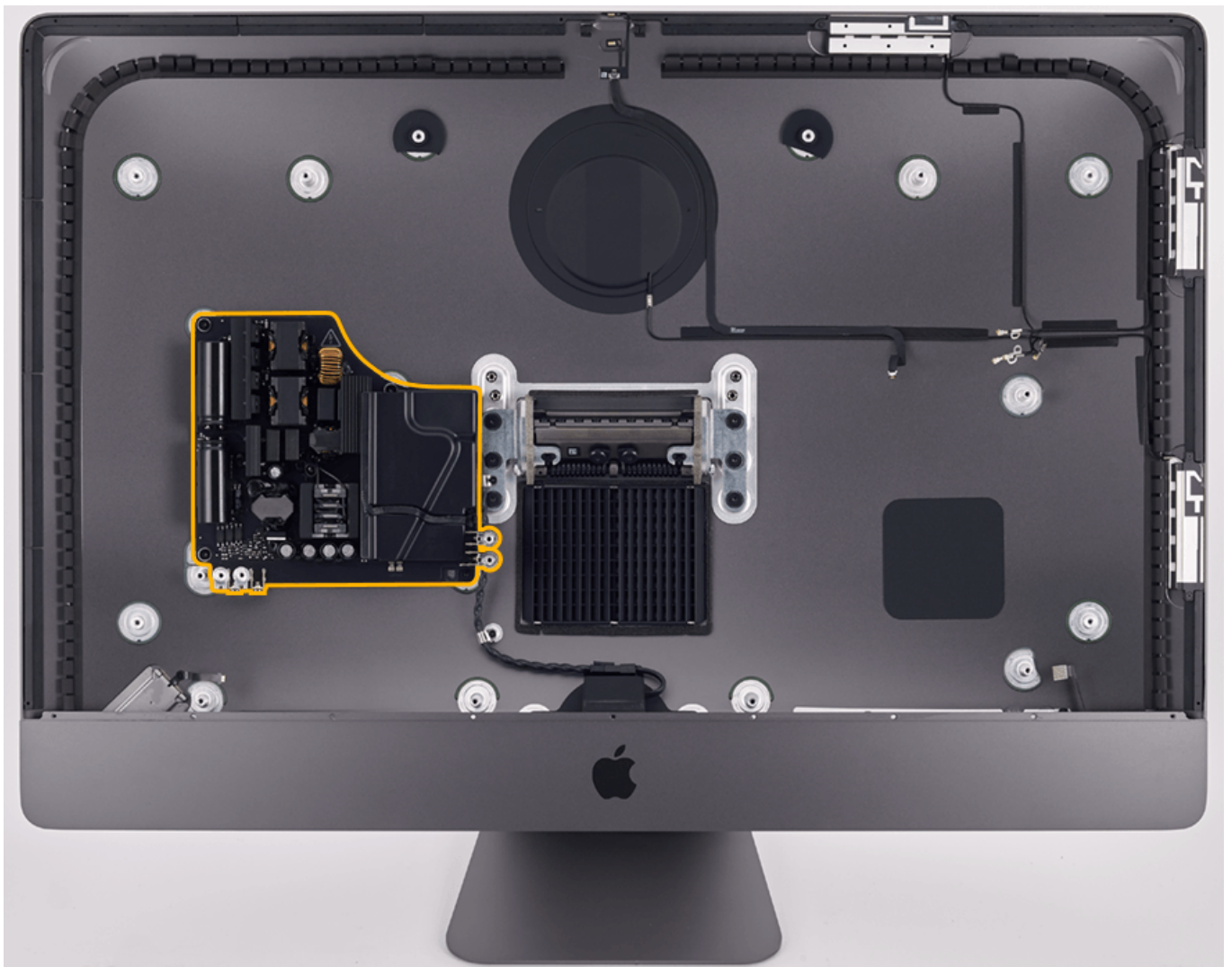
First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

For video instruction, refer to article [SV368: Power Supply Replacement Video](#).

Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)
- [Chin Strap](#)
- [Dual Fan Assembly](#)
- [Right Speaker](#)
- [Left Speaker](#)
- [Logic Board](#)



Tools

- ESD wrist strap
- Service wedge (iMac)
- Adjustable torque driver 0.3–1.2 Nm (923-0735) (for bus bar replacement)
- T8 security bit (923-0734) (for bus bar replacement)
- Torx T4 screwdriver (magnetized)
- Torx T8 screwdriver (magnetized)



Steps For Removal



Warning: HIGH VOLTAGE. Use extreme caution when troubleshooting with the display panel removed. Avoid touching the logic board or power supply while the computer is plugged in, the power supply retains a charge whether or not the computer is on.

After unplugging the computer from the electrical outlet, wait two minutes before removing display panel, disconnecting modules, or substituting cables and components. This will allow the power supply and logic board time to discharge.

- Never remove or install any physical components while the computer is plugged in to an electrical outlet.
- When plugged in, the power supply and logic board are energized, even when the computer is turned off.
- Unplug the computer and allow sufficient time for the power supply and logic board to self-discharge before removing the display panel.
- Do NOT touch the logic board or power supply while the computer is plugged in, or before sufficient time has passed to discharge stored voltage to a safe level after being unplugged.
- [TP1620: iMac Pro \(2017\): Power Supply Cover Instructions](#)
- [TP1637: iMac Pro \(2017\): Safety](#)

Electrical Safety Precautions

Before working on a computer with exposed, potentially energized parts:

- Remove rings, watches, necklaces, metal-rimmed eyewear, and other metallic articles which increase your risk of electric shock.
- Do not wear a cell phone or other signaling device, as these may cause a dangerous startle reflex during energized work.
- **If the iMac needs to be plugged in for LED checks or similar troubleshooting, do NOT wear an ESD wrist strap.** Wearing ESD grounding systems increases your risk of electric shock.
- Remain alert, focused on the work being performed, and aware of the proximity of grounded objects to your body.
- Use the plastic black stick or other nonmetal extension tool as needed to connect or disconnect cables, to keep fingers away from potentially energized parts.

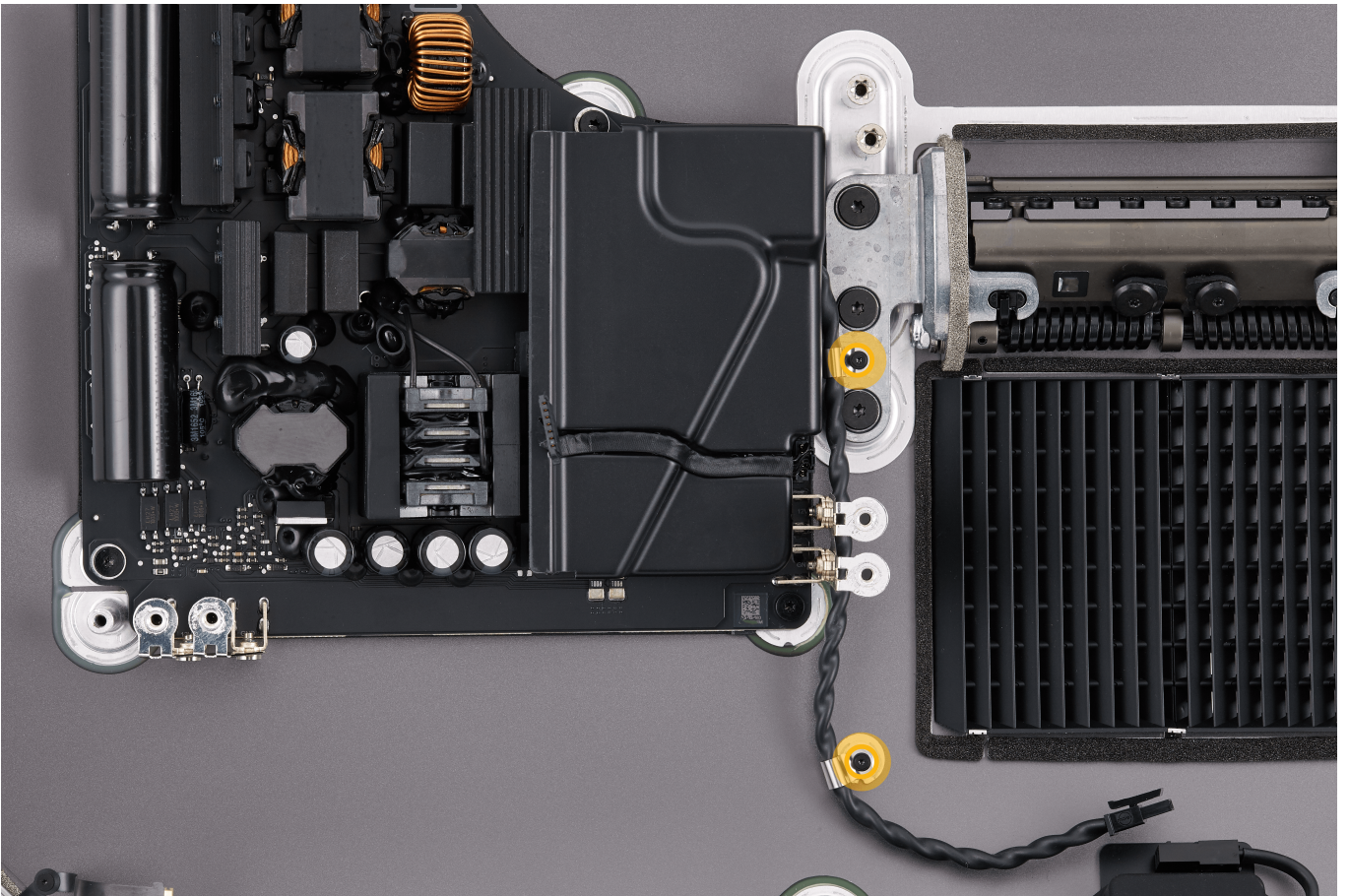
1. Disconnect the AC power inlet cable by pressing the clip and pulling the cable away from the power inlet.



2. Remove the two identical T5 screws that secure the cable to the enclosure.

- T5: 923-00609

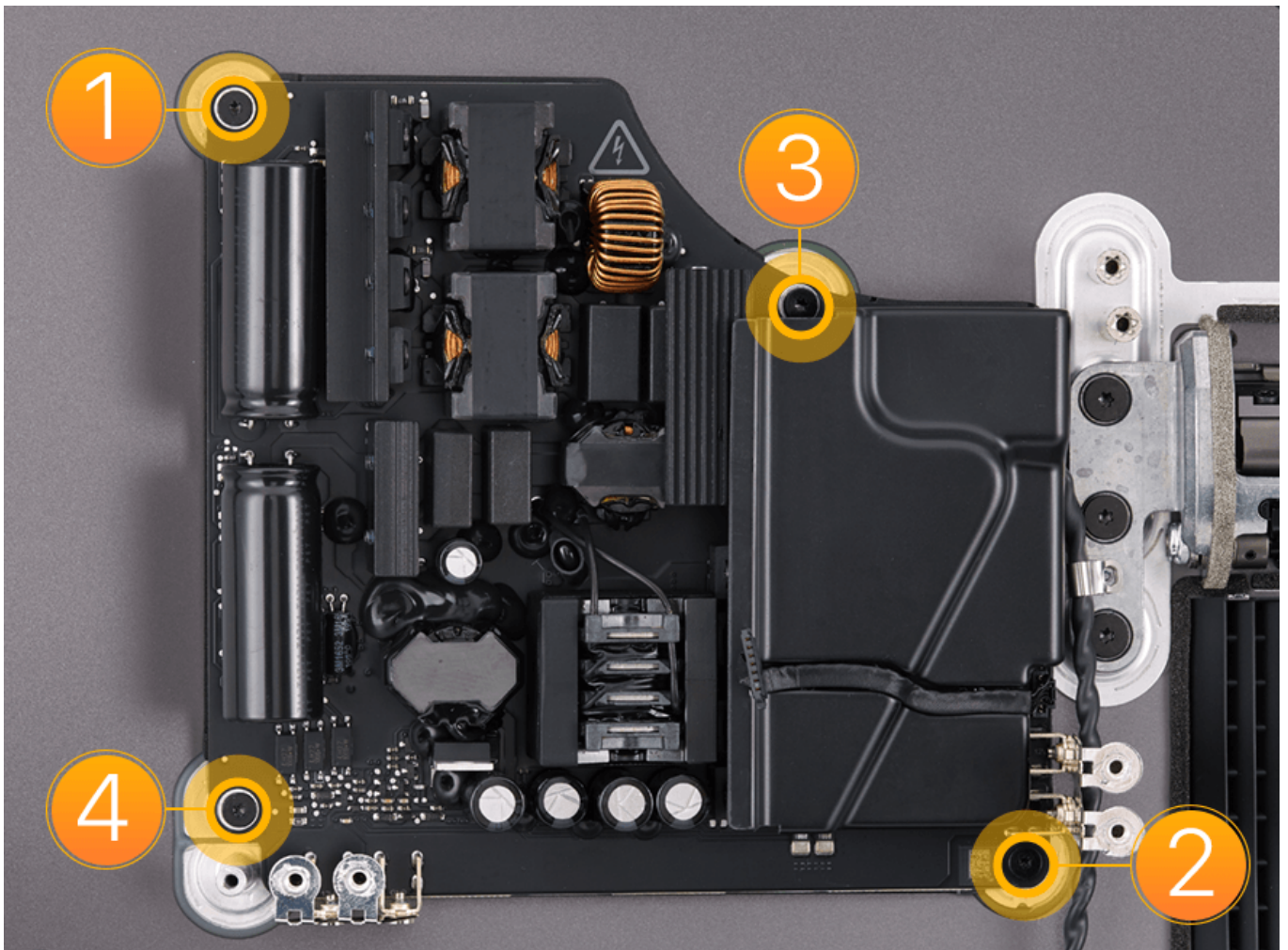




3. Remove the four identical T8 screws in the order below.

- T8: 923-02293

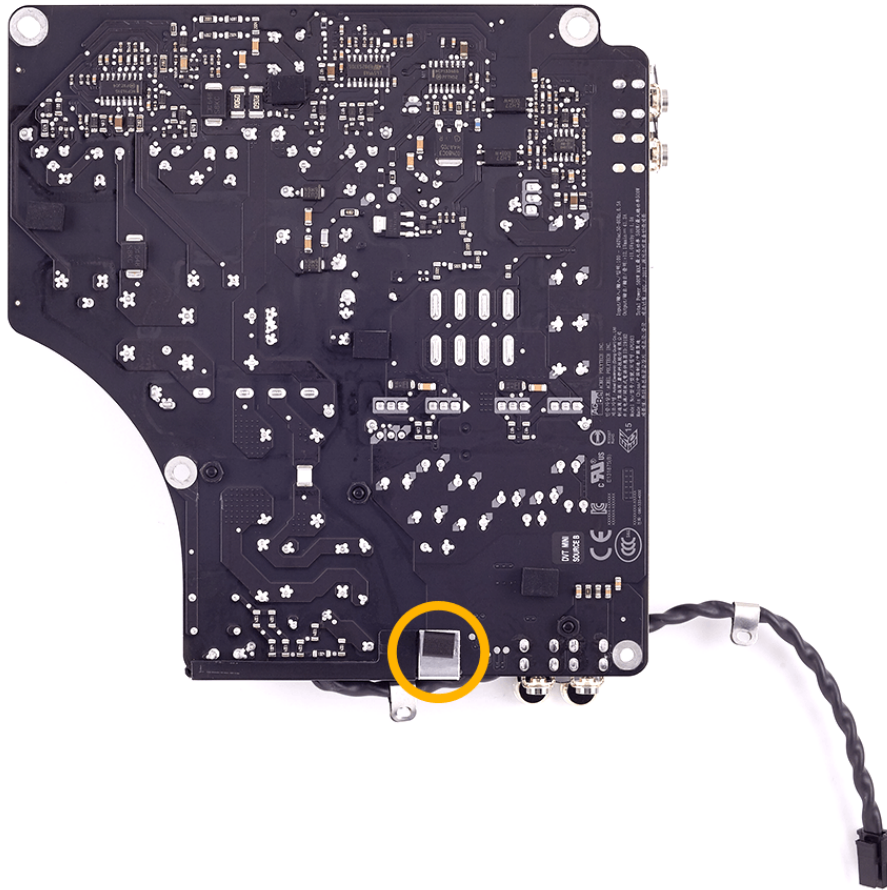




4. Lift the power supply out of the enclosure. Handle by the edges and be careful not to press on any of the components.

Steps For Reassembly

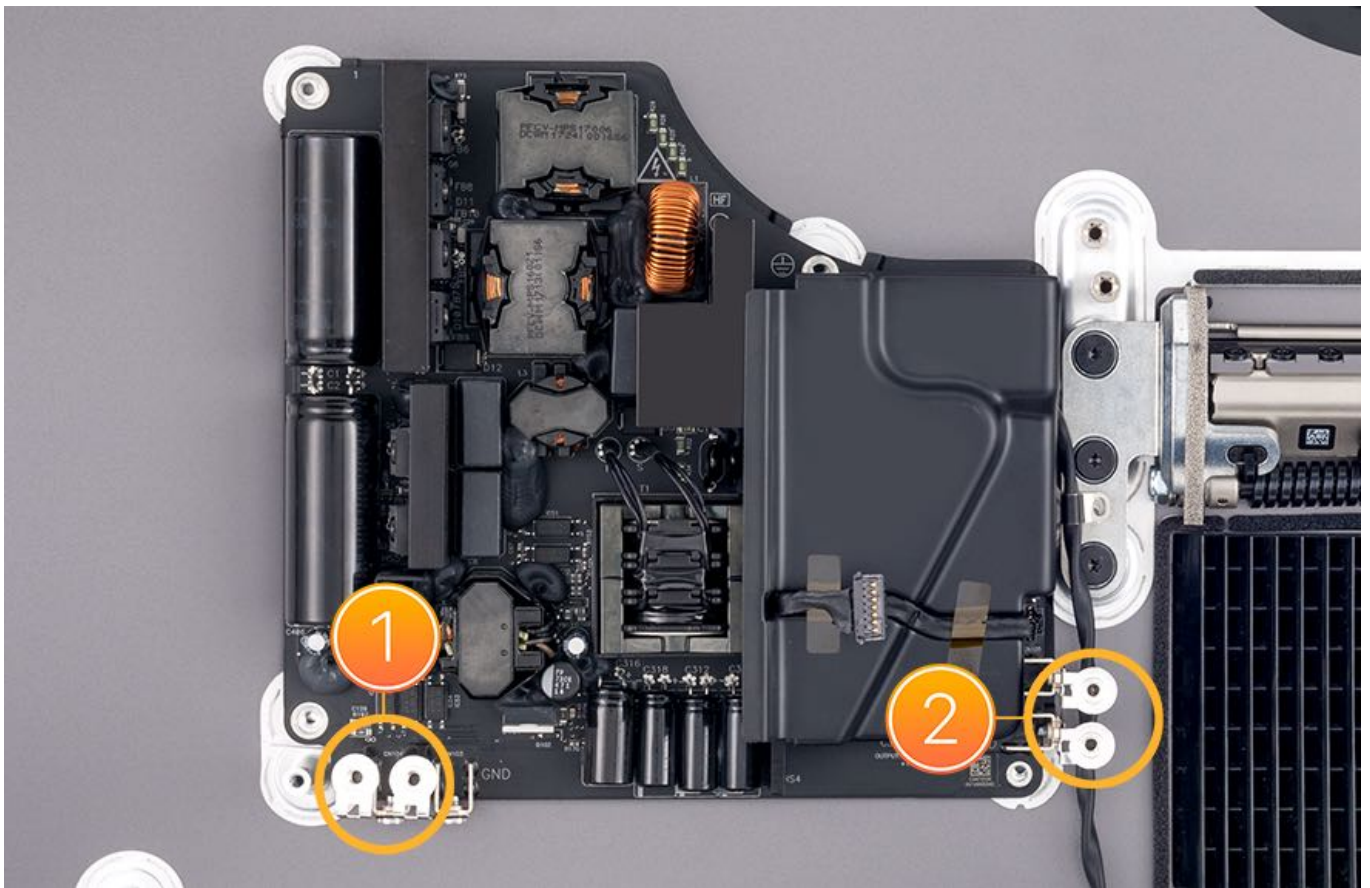
Caution: If the gasket on side of the power supply that faces the rear housing is missing, it must be replaced. Replacement gaskets are included with a replacement power supply.



Note: The power supply replacement kit includes the following parts that will be labeled with the numbers below:

- GPU bus bars (1) – 595-00140
- CPU bus bars (2) – 595-00141
- Bus bar to logic board screws – 452-00243
- Bus bar to PSU screws – 452-2981
- Gasket – 875-04789

For instructions on replacing the bus bars, refer to article [RP1419: Power Supply Bus Bars](#).



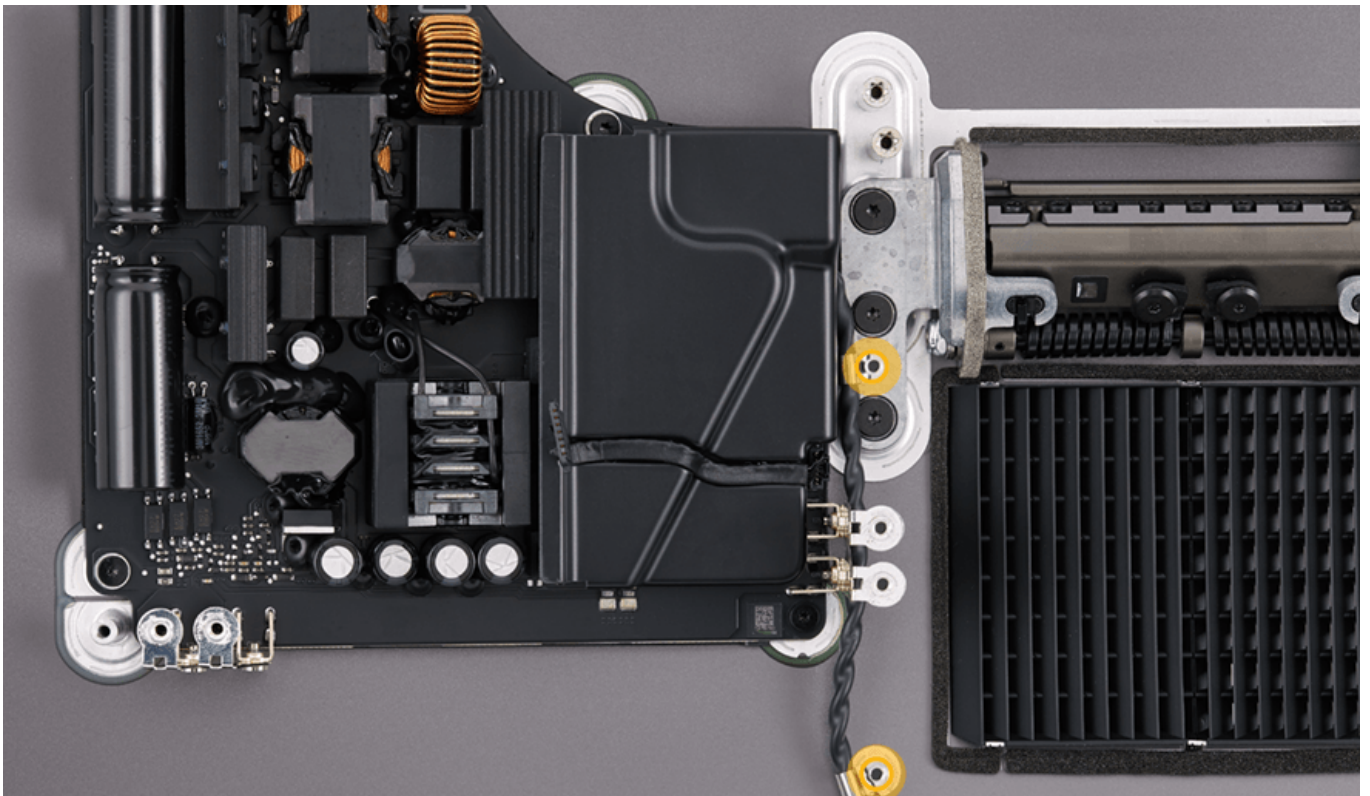
1. Lower the power supply into the rear housing and reinstall two T5 screws that secure the cable to the enclosure.

- T5: 923-00609





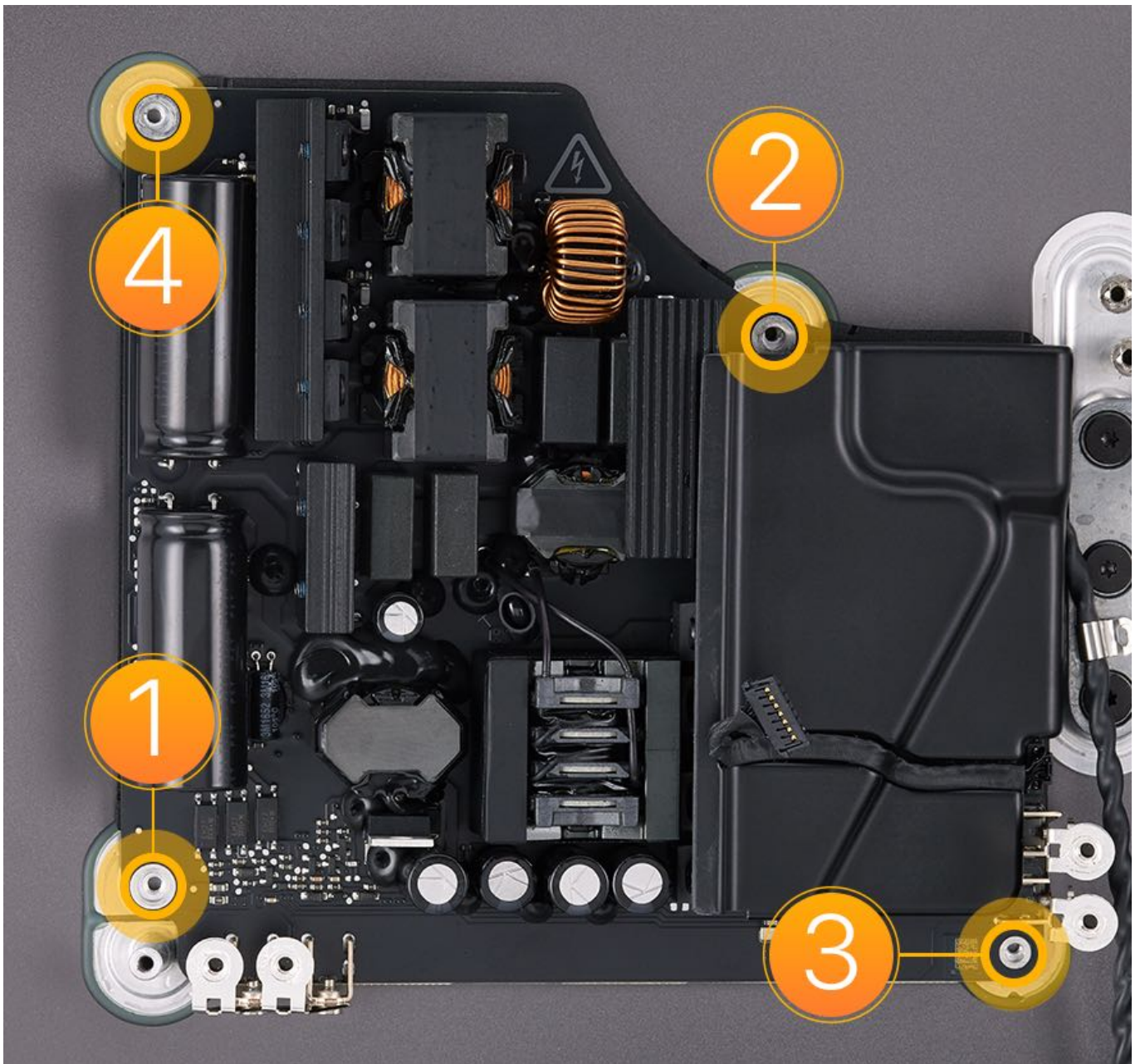
2. Reconnect the AC power inlet signal cable.



3. Align the corners of the power supply with the screw openings and reinstall the four T8 screws in the order shown.

- T8: 923-02293





5. Reinstall the [logic board](#).
6. Reinstall the [left speaker](#).
7. Reinstall the [right speaker](#).
8. Reinstall the [dual fan assembly](#).
9. Reinstall the [chin strap](#).
10. Reinstall the [display panel VHB strips](#).
11. Reinstall the [display panel](#).
12. Remove the bus bars from the KBB power supply before returning.

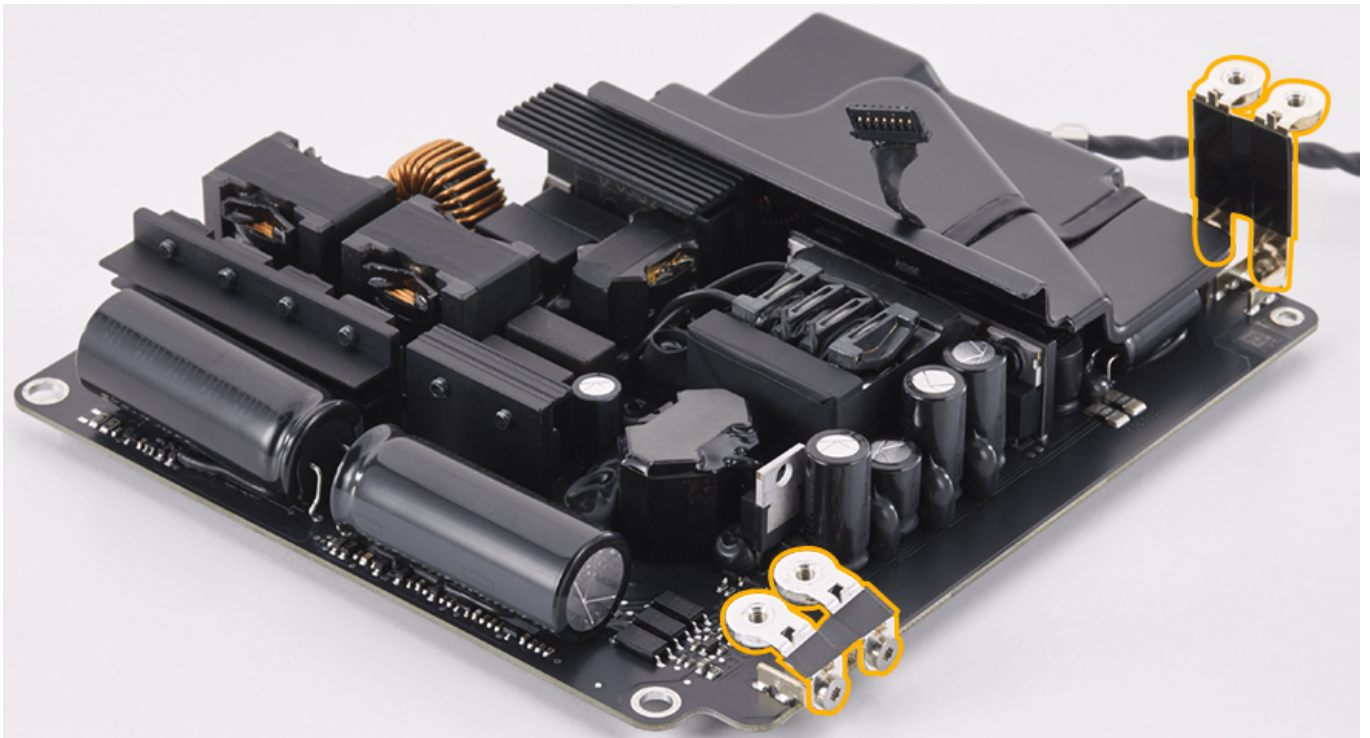
Power Supply Bus Bars

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)
- [Chin Strap](#)
- [Dual Fan Assembly](#)
- [Right Speaker](#)
- [Left Speaker](#)
- [Logic Board](#)
- [Power Supply](#)



Tools

- ESD wrist strap
- Service wedge (iMac)
- Adjustable torque driver 0.3–1.2 N m (923-0735)
- T8 security bit (923-0734)
- Torx T8 screwdriver (magnetized)



Steps For Removal



Warning: HIGH VOLTAGE. Use extreme caution when troubleshooting with the display panel removed. Avoid touching the logic board or power supply while the computer is plugged in, the power supply retains a charge whether or not the computer is on.

After unplugging the computer from the electrical outlet, wait two minutes before removing display panel, disconnecting modules, or substituting cables and components. This will allow the power supply and logic board time to discharge.

- Never remove or install any physical components while the computer is plugged in to an electrical outlet.
- When plugged in, the power supply and logic board are energized, even when the computer is turned off.
- Unplug the computer and allow sufficient time for the power supply and logic board to self-discharge before removing the display panel.
- Do NOT touch the logic board or power supply while the computer is plugged in, or before sufficient time has passed to discharge stored voltage to a safe level after being unplugged.
- [TP1620: iMac Pro \(2017\): Power Supply Cover Instructions](#)
- [TP1637: iMac Pro \(2017\): Safety](#)

Electrical Safety Precautions

Before working on a computer with exposed, potentially energized parts:

- Remove rings, watches, necklaces, metal-rimmed eyewear, and other metallic articles which increase your risk of electric shock.
- Do not wear a cell phone or other signaling device, as these may cause a dangerous startle reflex during energized work.
- **If the iMac needs to be plugged in for LED checks or similar troubleshooting, do NOT wear an ESD wrist strap.** Wearing ESD grounding systems increases your risk of electric shock.
- Remain alert, focused on the work being performed, and aware of the proximity of grounded objects to your body.
- Use the plastic black stick or other nonmetal extension tool as needed to connect or disconnect cables, to keep fingers away from potentially energized parts.

Note: The bus bars need to be replaced if bent or damaged in any way. New PSU will come with new bus bars, but bus bars can also be ordered separately in the case of damage (923-02288).

1. Remove the four identical T8 screws from the bus bars.

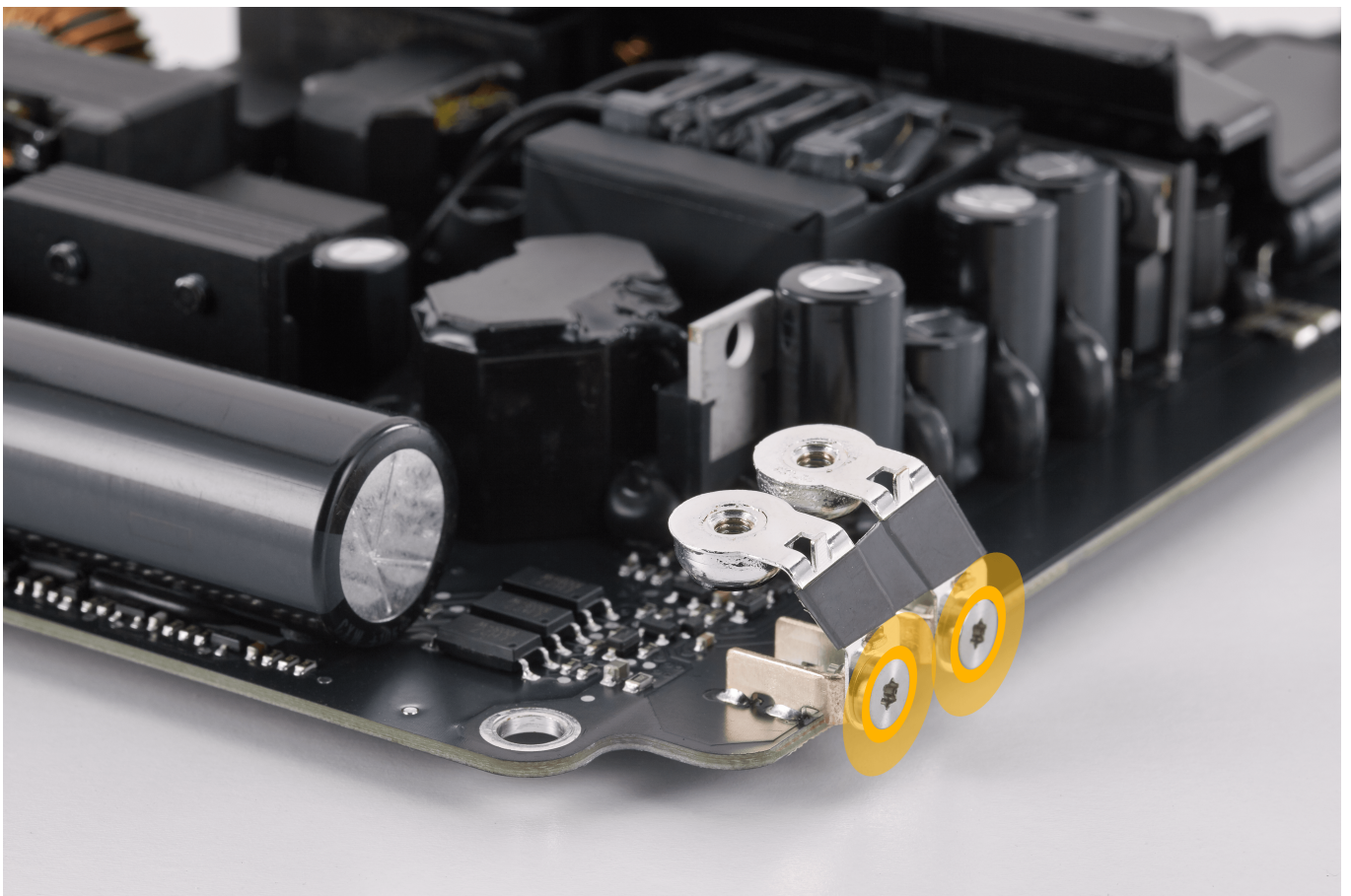
- T8: (923-0712)



CPU bus bars:



- GPU bus bars

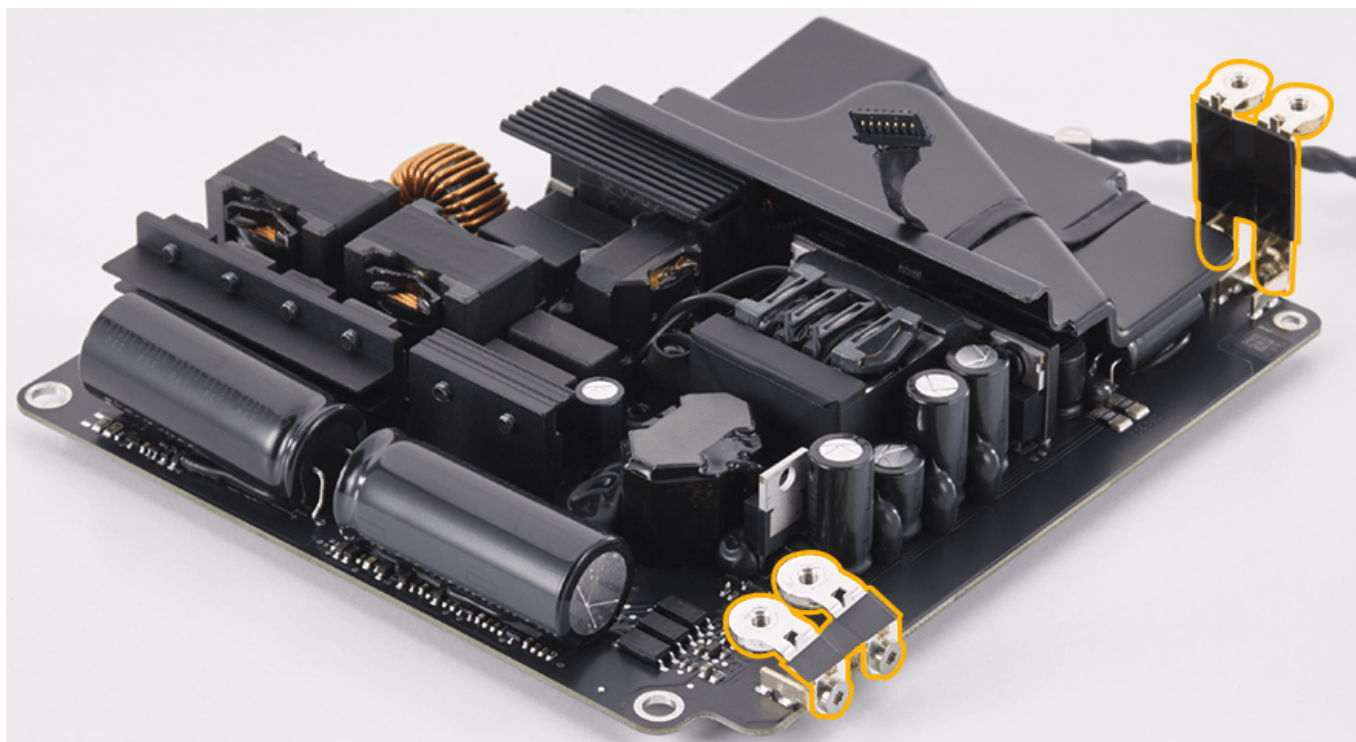


2. Remove the bus bars and make note of how the bus bars are attached to the power supply before you remove them. They must be replaced in the same way.

Steps For Reassembly

1. Replace the bus bars in the same direction they were taken off.

Caution: If the bus bars are facing the wrong way, damage to the power supply and/or the logic board can occur.



2. Reinstall the four identical T8 screws from the bus bars.

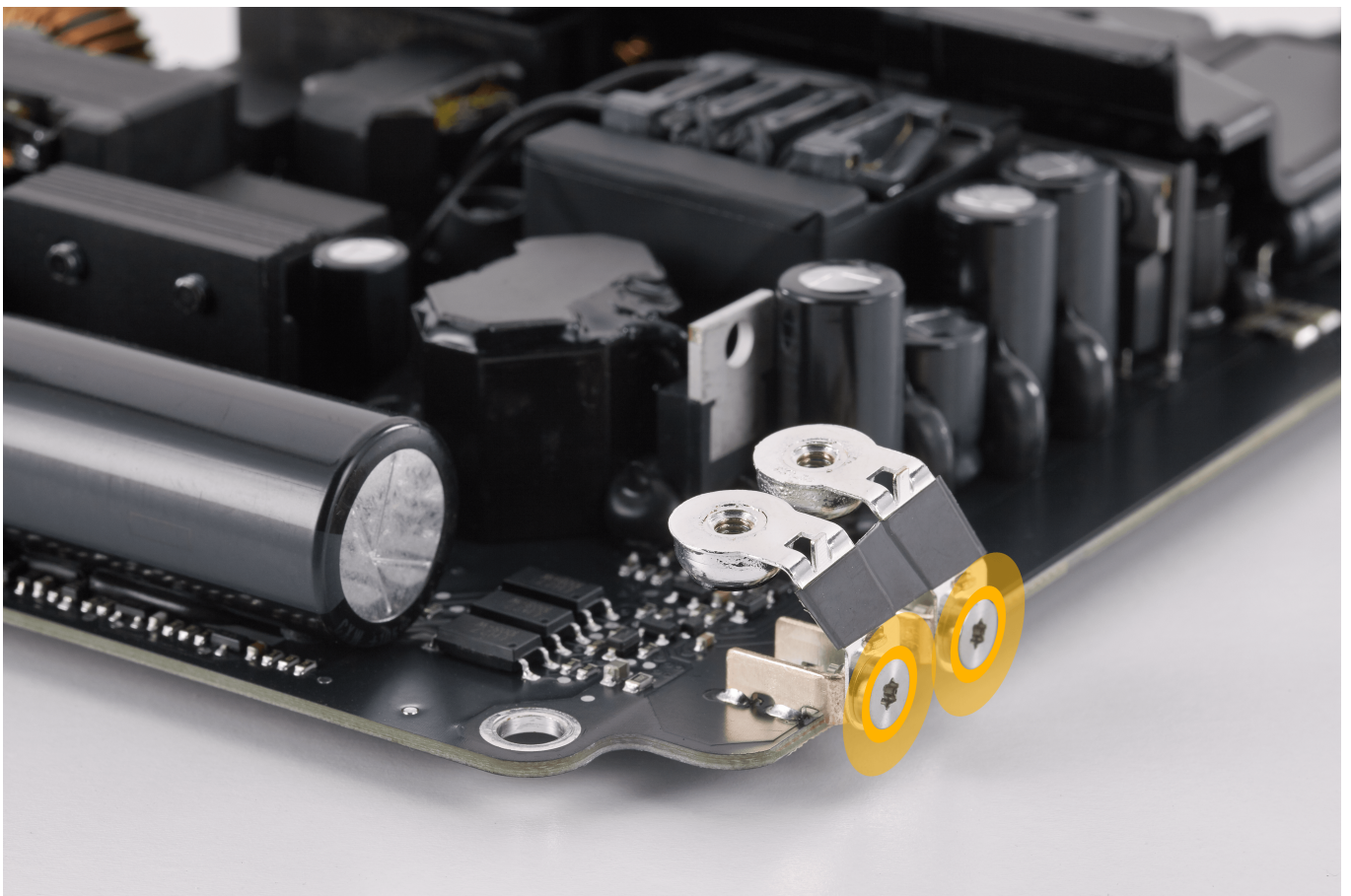
- T8: (923-0712)



CPU bus bars



GPU bus bars



3. Using the adjustable torque driver and the T8 security bit, tighten the screws to 7.5 inch pounds (in.-lb.) or 0.85 Newton metres (N m).



4. Reinstall the [power supply](#).
5. Reinstall the [logic board](#).
6. Reinstall the [left speaker](#).
7. Reinstall the [right speaker](#).
8. Reinstall the [dual fan assembly](#).
9. Reinstall the [chin strap](#).
10. Install new [display panel VHB strips](#).
11. Reinstall the [display panel](#).

Stand

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)
- [Dual Fan Assembly](#)
- [Chin Strap](#)
- [Right Speaker](#)
- [Left Speaker](#)
- [Logic Board](#)
- [Power Supply](#)

Tools

- ESD wrist strap
- Torx T10 screwdriver (magnetized)



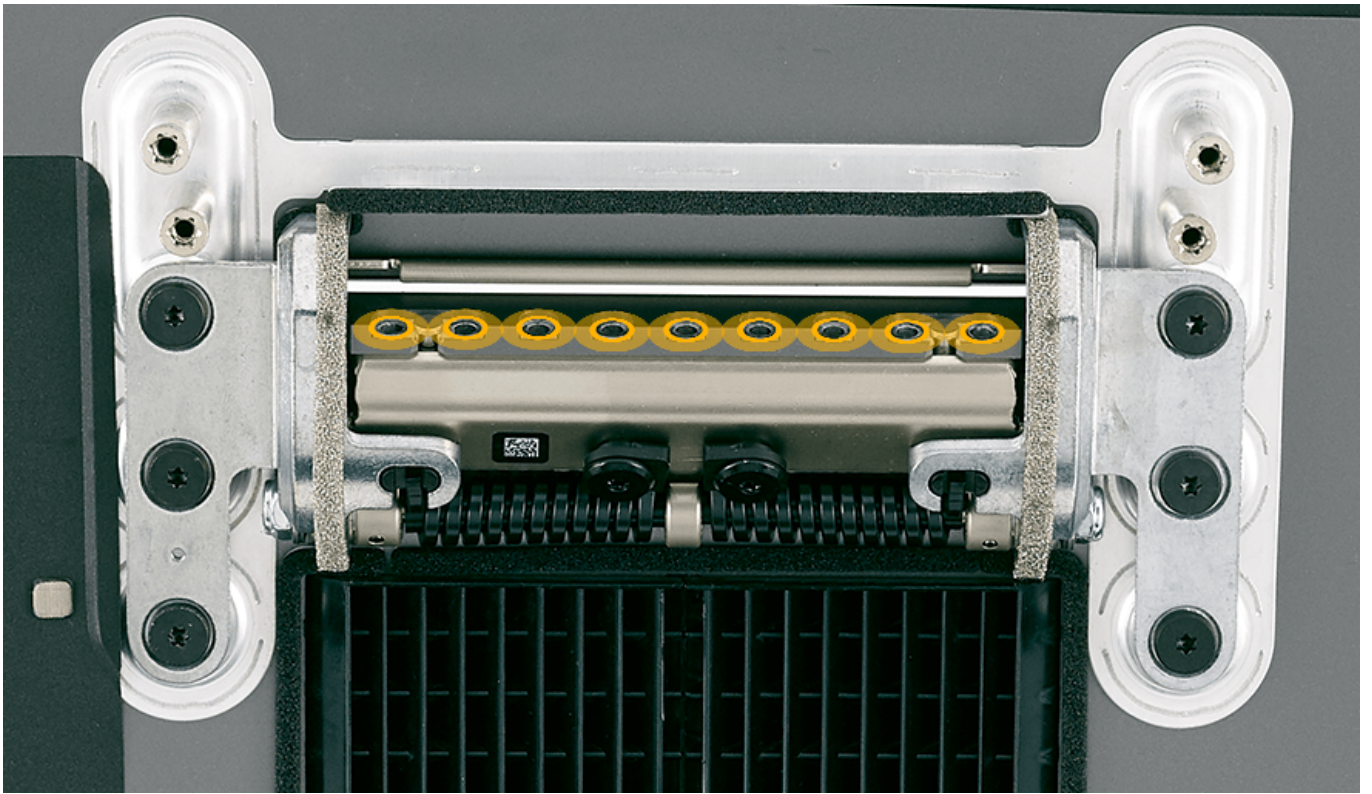
Steps For Removal

1. Remove nine T10 screws.

- T10: 923-00529

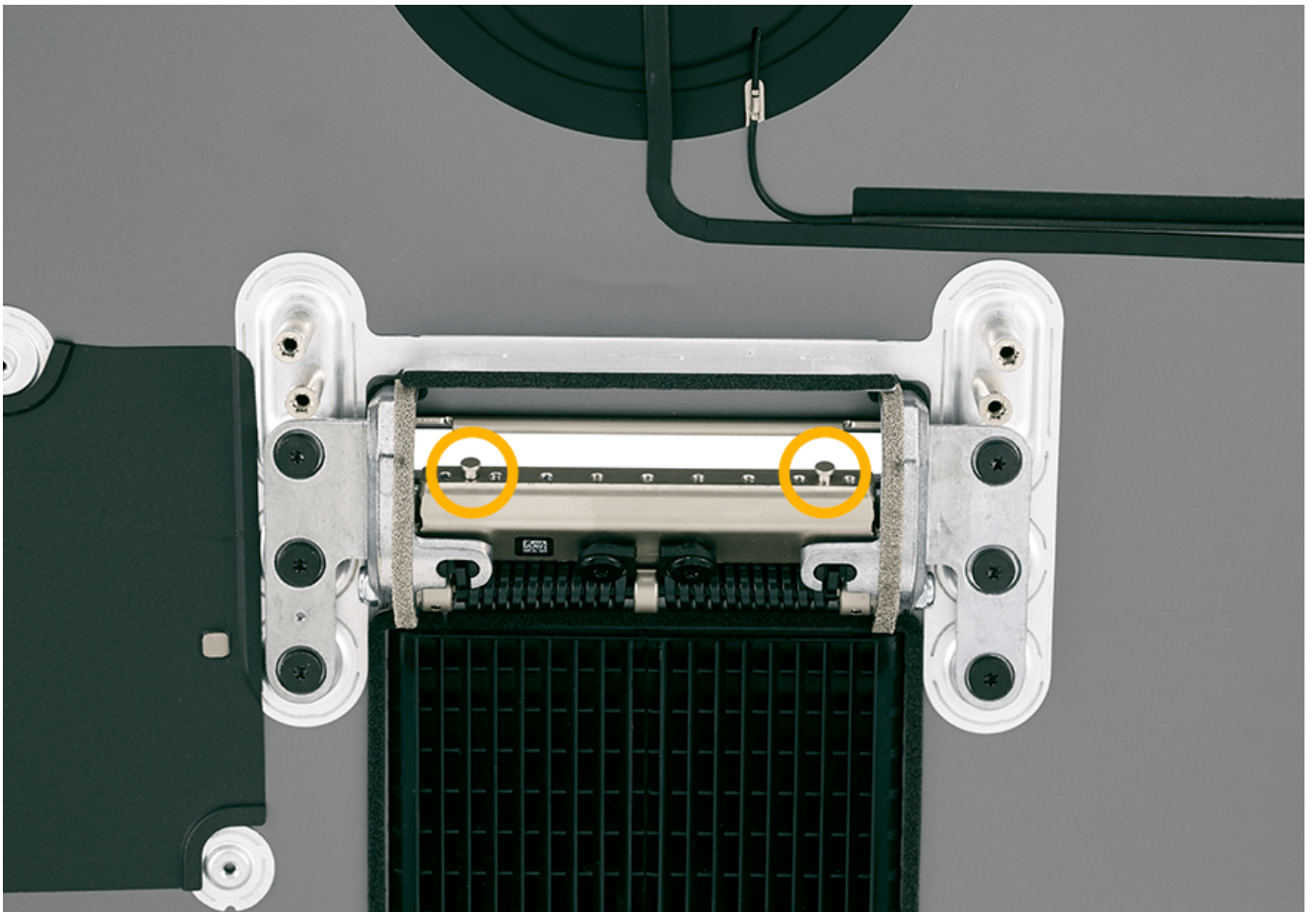


2. Lift the rear housing off of the stand, separating the stand from the mechanism.



Steps For Reassembly

1. Line up the two pins on the stand with the pin holes on the mechanism.



2. Replace the nine T10 screws in the order shown.

- T10: 923-00529



3. Reinstall the [power supply](#).
4. Reinstall the [logic board](#).
5. Reinstall the [left speaker](#).
6. Reinstall the [right speaker](#).
7. Reinstall the [dual fan assembly](#).
8. Reinstall the [chin strap](#).
9. Install new [display panel VHB strips](#).
10. Reinstall the [display panel](#).

Mechanism Retrieval

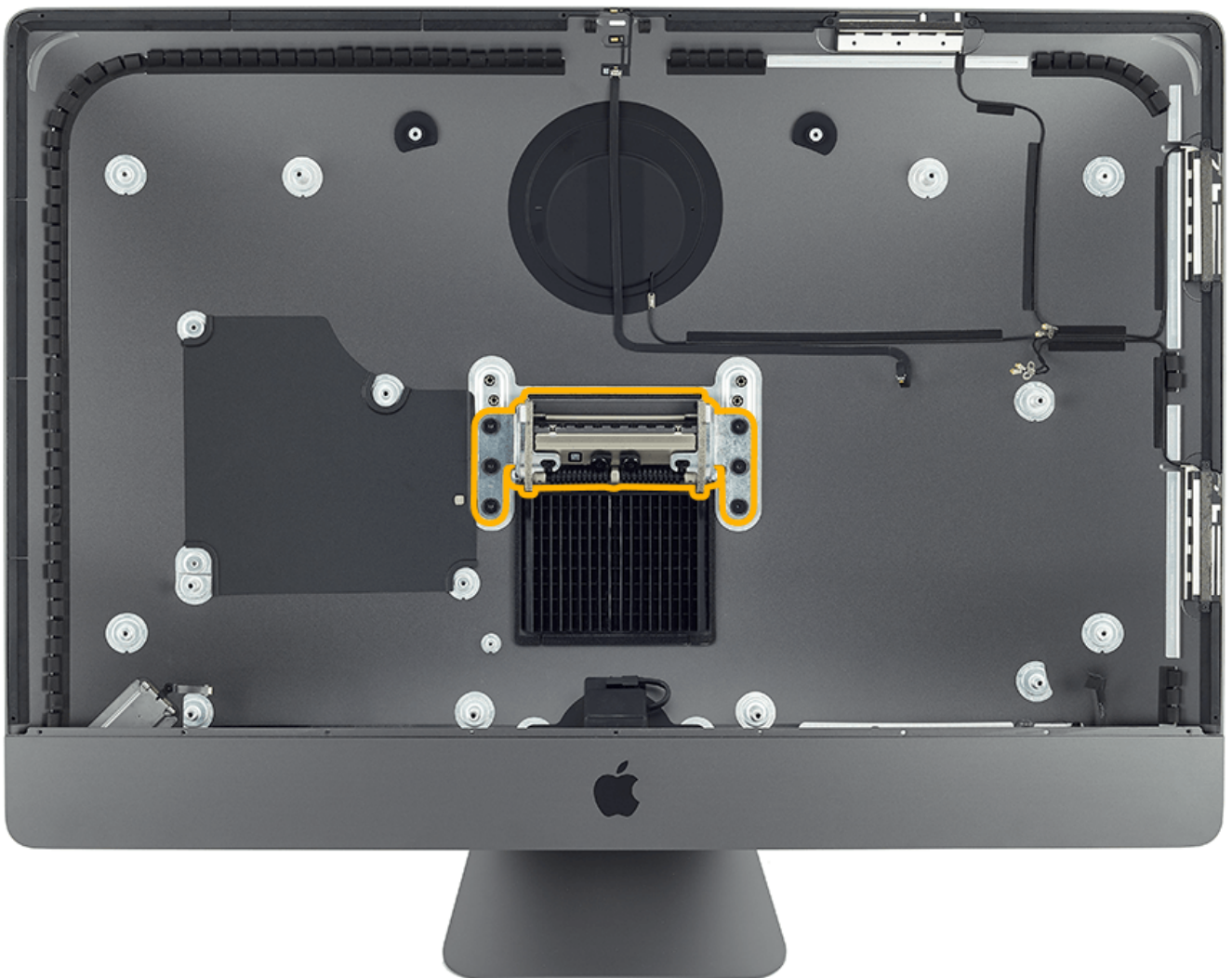
First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

Note: This procedure will need to be performed if the mechanism has retracted during customer installation of the customer-installable VESA mount.

Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)
- [Dual Fan Assembly](#)
- [Chin Strap](#)
- [Right Speaker](#)
- [Left Speaker](#)
- [Logic Board](#)
- [Power Supply](#)



Tools

- Service wedge (iMac)
- ESD wrist strap and mat
- Torx T10 screwdriver



Steps For Removal

In order to retrieve a mechanism that has retracted into the rear enclosure, it is necessary to remove all of the parts listed in First Steps.

Steps For Reassembly

If a mechanism retracted into the rear enclosure and was retrieved via parts removal, then follow the reassembly steps in [RP1424: Stand](#).

Note: Customer will need to provide the stand.

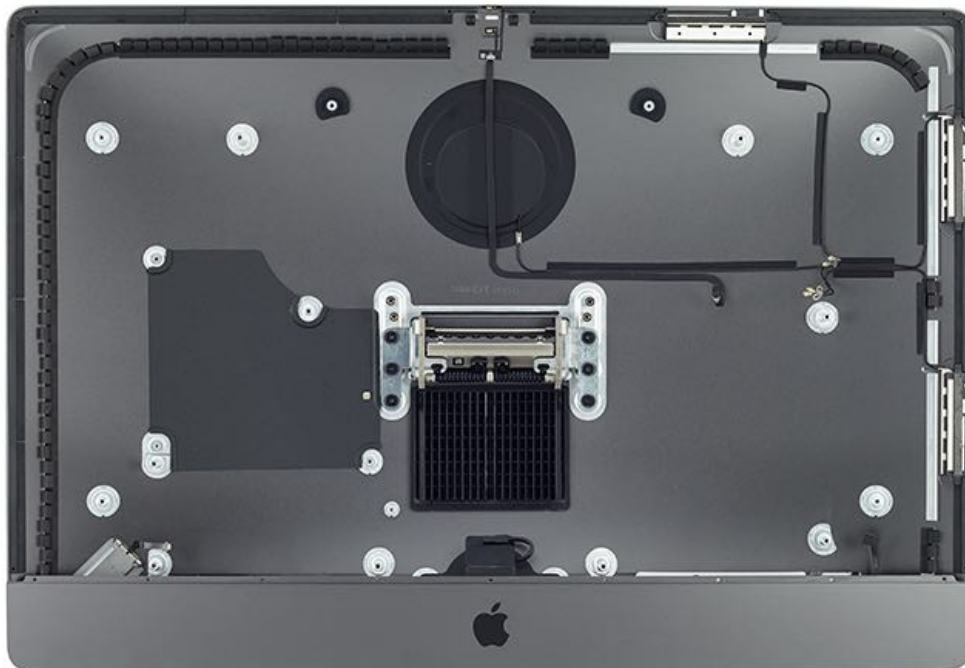
Rear Housing

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [OP1859: About Apple service certifications](#).

Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)
- [Dual Fan Assembly](#)
- [Chin Strap](#)
- [Right Speaker](#)
- [Left Speaker](#)
- [Logic Board](#)
- [Power Supply](#)
- [Stand](#)



Tools

- ESD wrist strap
- Lint-free cloth

Steps For Removal

When all other modules have been removed, the rear housing is the remaining part.

The rear housing includes the following parts, which are also available separately:

- Mechanism (923-01906)
- Mechanism screws (923-0334)
- Chin strap (923-01905)
- Chin strap screws (923-0338), package of 9
- Fan standoff (923-02287)
- Rear mic cable (923-02285)

The rear housing includes the following parts, which are **not** available separately:

- Wi-Fi antenna (in black circle behind Apple logo)
- Power button and cable
- Audio cable
- AC inlet
- Gaskets
- Wireless antenna insulator tape

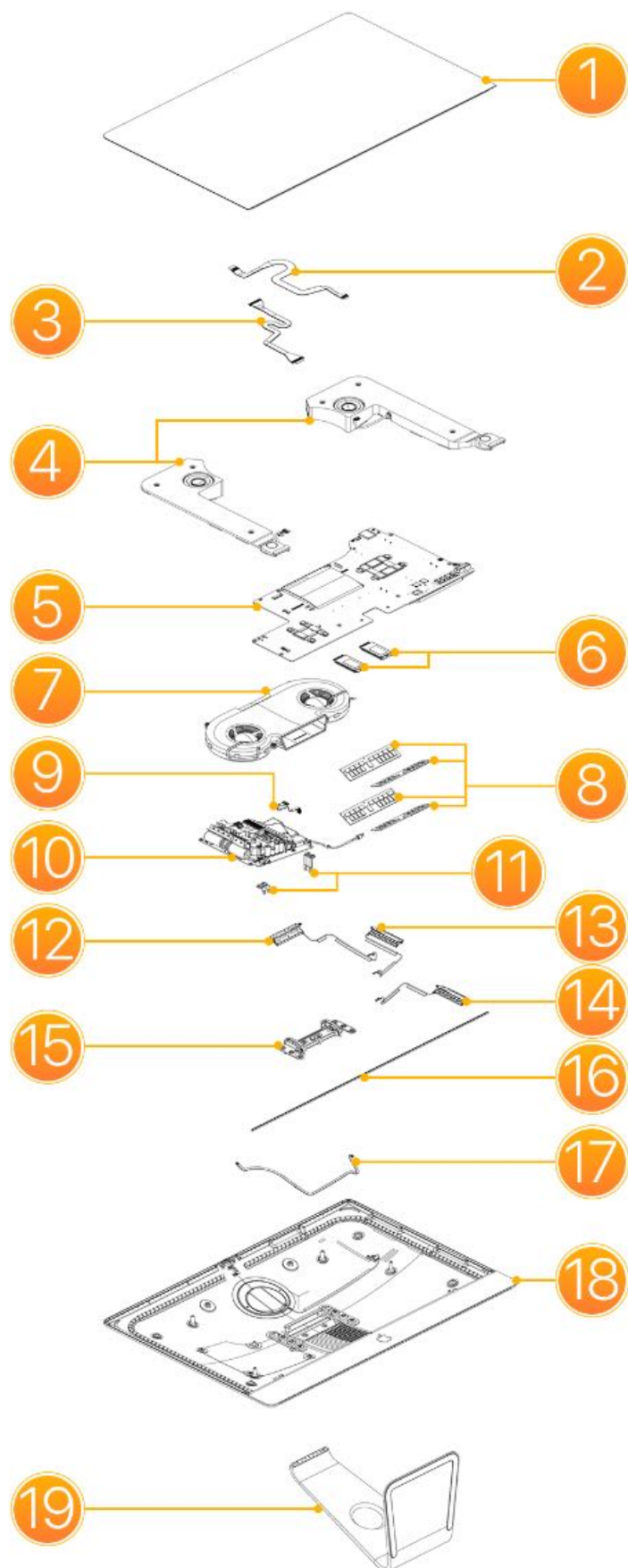
Steps For Reassembly

Always handle the rear housing with two hands in the lower left and right corners. Never carry the rear housing with a single hand, or by holding the aluminum chin (where the Apple logo appears on the lower front).

1. Reinstall the [stand](#).
2. Reinstall the [power supply](#).
3. Reinstall the [logic board](#).
4. Reinstall the [left speaker](#).
5. Reinstall the [right speaker](#).
6. Reinstall the [dual fan assembly](#).
7. Reinstall the [chin strap](#).
8. Install new [display panel VHB strips](#).
9. Reinstall the [display panel](#).

Exploded View

Exploded View for iMac Pro (2017)



- 661-08897

2. Cable, Camera/Front Mic

- 923-02284

3. Cable, Embedded DisplayPort (eDP)

- 923-02214

4. Speaker, Pair, Left and Right

- 923-02026

5. Logic Board

- 661-08867, 8-Core, VEGA56, FCC
- 661-08868, 8-Core, VEGA56, ETSI
- 661-08869, 8-Core, VEGA56, ROW
- 661-08871, 8-Core, VEGA64, FCC
- 661-08872, 8-Core, VEGA64, ETSI
- 661-08873, 8-Core, VEGA64, ROW
- 661-08875, 10-Core, VEGA56, FCC
- 661-08876, 10-Core, VEGA56, ETSI
- 661-08877, 10-Core, VEGA56, ROW
- 661-08879, 10-Core, VEGA64, FCC
- 661-08880, 10-Core, VEGA64, ETSI
- 661-08881, 10-Core, VEGA64, ROW
- 661-09633, 14-Core, VEGA56, FCC
- 661-09634, 14-Core, VEGA56, ETSI
- 661-09635, 14-Core, VEGA56, ROW
- 661-09637, 14-Core, VEGA64, FCC
- 661-09638, 14-Core, VEGA64, ETSI
- 661-09639, 14-Core, VEGA64, ROW
- 661-08883, 18-Core, VEGA56, FCC
- 661-08884, 18-Core, VEGA56, ETSI
- 661-08885, 18-Core, VEGA56, ROW
- 661-08887, 18-Core, VEGA64, FCC
- 661-08888, 18-Core, VEGA64, ETSI
- 661-08889, 18-Core, VEGA64, ROW

6. Flash Storage

- 661-08894, 1TB (2 x 512GB)
- 661-08895, 2TB (2 x 1TB)
- 661-08896, 4TB (2 x 2TB)

7. Dual Fan Assembly

- 923-02027

8. Memory

- 661-08891, 8GB, DDR4 ECC, 2666MHz
- 661-08892, 16GB, DDR4 ECC, 2666MHz
- 661-08893, 32GB, DDR4 ECC, 2666MHz

9. Cable, Power Supply Signal

- 923-02305

10. Power Supply

- 661-08944

11. Bus Bars

- 923-02289, GPU
- 923-02290, CPU
- 923-02288, Screws, Bus Bar to Power Supply, 5-pack

12. Upper Wi-Fi Antenna

- 923-01907

13. Middle Wi-Fi Antenna

- 923-01908

14. Lower Wi-Fi Antenna

- 923-01909

15. Mechanism

- 923-01906

16. Chin Strap

- 923-01905

17. Cable, Rear Mic

- 923-02285

18. Rear Enclosure

- 923-02292

19. Stand

- 923-02216

Tools and Fixtures

- See article [TP818: Required Tools](#).

Note:

- The customer must provide a BR2032 or CR2032 coin cell battery if replacement is necessary. The batteries can no longer be ordered.
- BR2032 and CR2032 batteries have the same form factor and nominal voltage. However, BR2032 batteries have a lower self-discharge rate and broader operating temperature range than CR2032 batteries for longer shelf and service life.

Screw Chart

Screw Chart for iMac Pro (2017)

Note: Screws are not to scale.

923-0304 T4  Bluetooth antenna (2), Middle Wi-Fi antenna (2), Lower Wi-Fi antenna (2)	923-0331 T8  Logic board (6)	923-0333 T10  Right speaker (3), Left speaker (3)
923-0334 T10  Mechanism (6)	923-0338 Phillips #00  Chin strap (9)	923-0396 T8  Logic board (2)
923-0712 T8  Bus Bar to Power Supply, 5pk (4)	923-00609 T5  Power Supply Flex Cable, 5pk (2)	923-00669 T10  Fan, 5pk (4)
923-02215 T10  Stand, 10pk (9)	923-02287 T25  Fan standoff (2)	923-02288 T8  Bus Bar to Logic Board, 5pk (4)

923-02291
T5



Audio Jack Cowling (1)

923-02293
T8



Power Supply, 5pk (4)

923-02294
T5



Antenna clip, 5pk (2)

923-02313
T8



Flash Storage, 5pk (2)

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